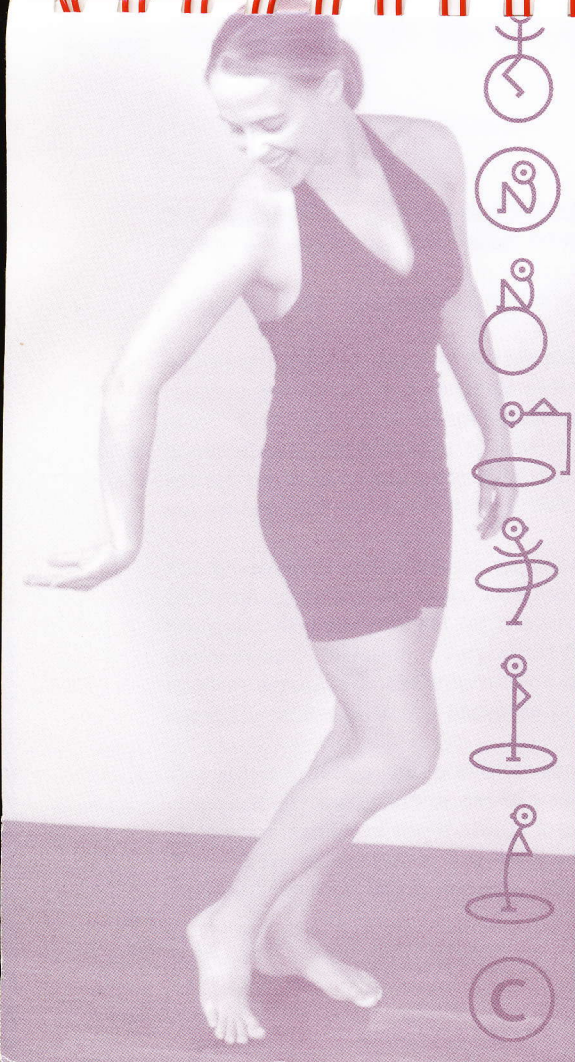


The Neurodynamic Techniques

A DEFINITIVE GUIDE FROM THE NOIGROUP TEAM
DVD AND HANDBOOK - EDITED BY DAVID BUTLER



Neuro Orthopaedic Institute Australasia



The Neurodynamic Techniques

A definitive guide from the Noigroup team

Neuro Orthopaedic Institute Australasia Pty Ltd

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Our international faculty

NOI instructors are hand selected on the basis of their existing skills and expertise and undergo progressive peer and expert training. All instructors have postgraduate manual therapy educations and are members of national associations and of the International Association for the Study of Pain.

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Introduction

This neurodynamics techniques DVD and book has been produced by the *Neuro Orthopaedic Institute Australasia*, with contributions from our international faculty. It is expected that users will be health professionals, and thus will have an existing knowledge of neuroanatomy and neuro orthopaedic assessment plus knowledge of relevant pathology, precautions and contraindications.

For optimal and safe clinical integration, it is highly recommended that this DVD and book be used in association with NOI education seminars (www.noigroup.com) and/or used with the textbooks *Mobilisation of the Nervous System* or preferably, *The Sensitive Nervous System*.

This DVD and book should not be taken as just a list of exercises, but more a series of ideas. For example, techniques may be demonstrated to illustrate a particular principle for one nerve, but similar techniques could be used for other neural structures.

Nine key points

1 > What is a neurodynamic test?

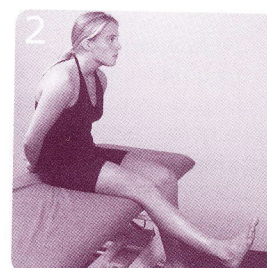
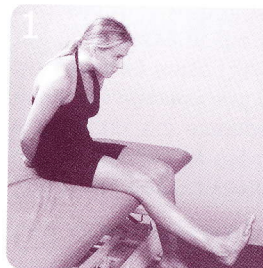
Neurodynamics is the science of the relationships between mechanics and physiology of the nervous system. Simply put – it is the assessment and treatment of the physical health of the nervous system. Just as a joint moves and a muscle stretches, the nervous system also has physical properties that are essential for movement. You can examine these properties via nerve palpation and neurodynamic tests.

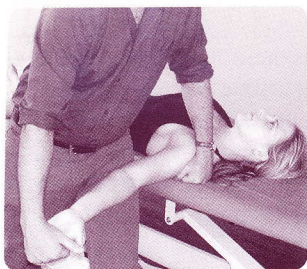
2 > The nervous system is a continuum

A mechanical, electrical and chemical continuum exists in the nervous system. This is the basis of tests such as the slump test, where for example, the position of the neck will influence neural responses in the leg.

3 > Structural differentiation

The neural continuum allows a differentiation between neural and non-neural tissues. For example, in the case of the slump test (see below), if neck extension which takes load off the nervous system eases evoked symptoms in the leg, then this provides some clinical data to suggest that there is a physical health issue in the nervous system.





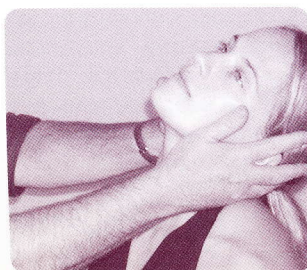
4 > Neural relations to joint axes dictates load

The nervous system is usually behind, in front, or to the side of joint axes of movement. This means that the physical loading on the nervous system will be dictated by joint position. In the example shown of the

Upper Limb Neurodynamic Test (ULNT), wrist extension, elbow extension, and shoulder abduction would be examples of movements which challenge the median nerve and the brachial plexus. If you know your anatomy, you could make up neurodynamic tests yourself.

5 > Pinch and tension - the key role of neighbouring structures

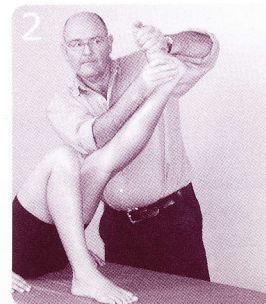
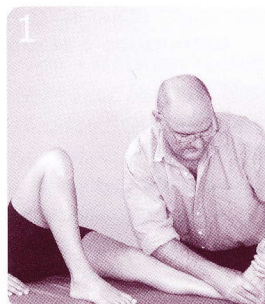
Most neurodynamic tests are tests of the ability of the nervous system to elongate. The neighbouring structures (e.g. joint and muscle) which 'contain' the nervous system can sometimes pinch it. Wrist flexion is a test of the neural container around the median nerve at the carpal tunnel, and the Spurling's test (illustrated here) is an example of a pinch test for lower cervical nerve roots.



6 > Order of Movement

The strain and movement of the nervous system will be affected by the order in which the movement is taken up. For example, as illustrated, if you add ankle dorsiflexion and eversion and then perform a Straight Leg Raise (SLR), a neurogenic problem in the tibial nerve at the ankle is more likely to be exposed than with other combinations.

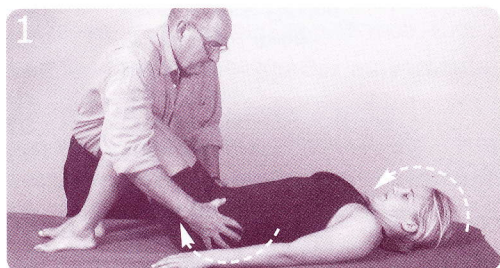
There are probably two reasons for this: a more mechanical reason where the neural tissues are 'borrowed' from other areas and thus given more of a chance to be challenged, or perhaps the first movement is the one which takes priority in the patient's consciousness.



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7 > Sliders and tensioners

A tensioner (1) can be a vigorous technique which 'pulls from both ends' of the nervous system. A slider (2) is a 'flossing' movement where tension is placed at one end of the system and slack at the other. Sliders provide a large amount of neural movement and are a neurally nonaggressive movement for anxious patients.



8 > Recording

Abbreviations such as **PF/IN/SLR** inform the order and kind of movement, thus ankle plantar flexion first, then inversion and then Straight Leg Raise. Each component can also be quantified in terms of range of movement or qualified in terms of symptoms evoked.

The 'In:Did' system is also used. For example, **In: HF/LR Did: KE** means that in the hip flexion and lateral rotation position, knee extension was performed.

9 > Don't forget the brain

Remember that responses to these tests may not always be due to physical health issues in the nervous system. In some patients the sensitivity evoked during testing may be due to changes in the central nervous system. There is much more on this important part of assessment in *The Sensitive Nervous System*.

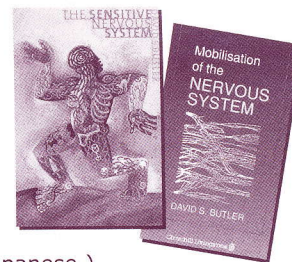
Glossary

C/T . . .	Cervico-thoracic
DF	Dorsiflexion
EV	Eversion
GH	Glenohumeral
HAB . . .	Hip abduction
HAd . . .	Hip adduction
HE	Hip extension
HF	Hip flexion
IMT . . .	Intermetatarsal
IN	Inversion
KE	Knee extension
KF	Knee flexion
Lat flex .	Lateral flexion
LR	Lateral rotation
LS	Longsitting
NF	Neck flexion
PF	Plantar flexion
PKB . . .	Prone Knee Bend
PNF . . .	Passive Neck Flexion
Rad . . .	Radial
SKB . . .	Slump Knee Bend
sli	slider
SLR . . .	Straight Leg Raise
SLS	Slump Long Sit
SLY	Slump sidelying
SP	Spinal
Sup TF .	Superior tibiofibular
ten	tensioner
Thx	Thorax
ULNT . .	Upper Limb Neurodynamic Test

References

Butler DS (2000) *The Sensitive Nervous System*, ISBN 0-646-40251-X, NOI Publications, Adelaide.

Butler DS (1991) *Mobilisation of the Nervous System*, ISBN 0-443-04400-7, Churchill Livingstone, Melbourne.
(Also in German, Italian, Spanish and Japanese.)



Support material

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Peroneal nerve > anatomy and palpation

p1

Palpable areas

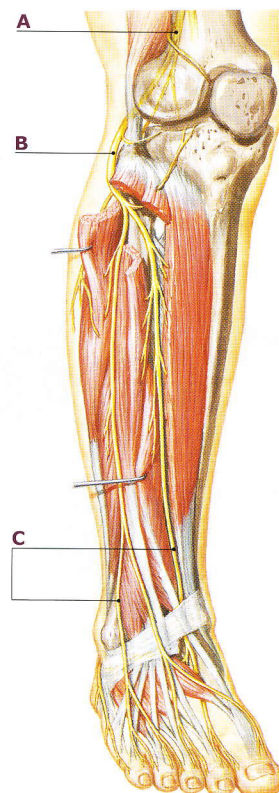
- A** Medial to Biceps Femoris
- B** At the head of the fibula
- C** Dorsum of the foot
(both superficial and deep peroneal nerves)

Common entrapments / syndromes

Lower lumbar spine
Piriformis area
Superior tibiofibular joint
Lower limb compartments
Ankle extensor retinaculum

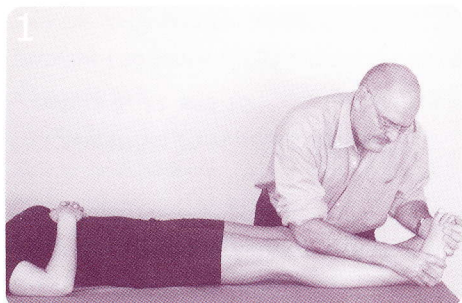
The Sensitive Nervous System

Chapters 8, 11 and 15

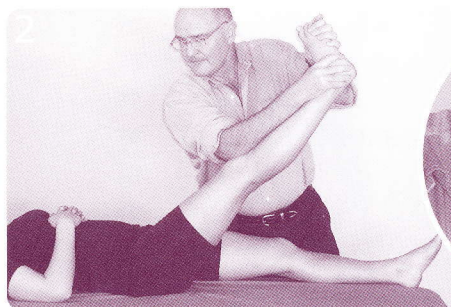


F. Netter M.D.
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ILLUSTRATIONS

PF/IN/SLR



Foot held in plantar flexion/inversion

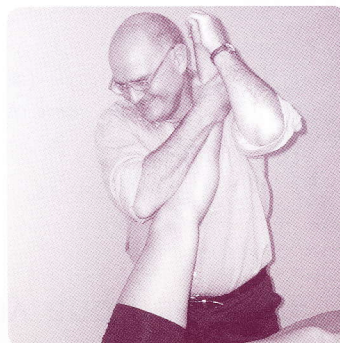


As the hip is flexed the therapist's arm maintains knee extension



PF/IN/SLR via shoulder

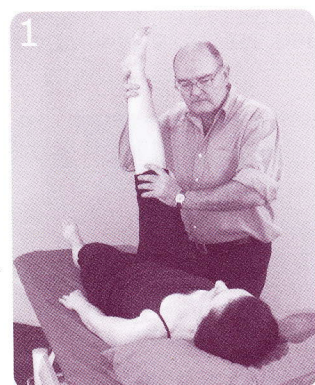
More mobile subjects require the technique variation shown. The leg is placed on the therapist's shoulder and then 'walked' up.



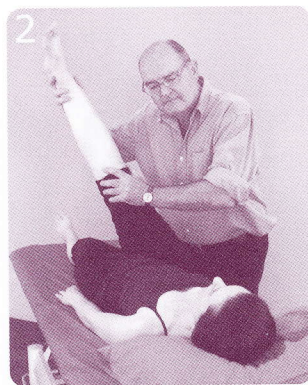
Peroneal nerve > passive techniques

In: SLR/HAd/HMR/SP flex

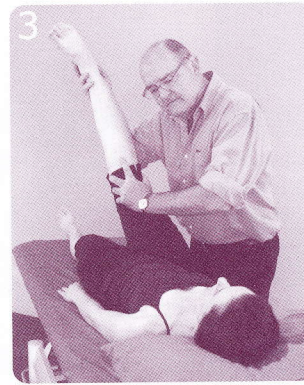
These four images show increasing tension being placed upon the peroneal and the neuromeningeal system. Exploring these movements may be necessary for minor physical health issues of the peroneal nerve (add PF/IN) or tibial (add DF/EV) or situations where there is a spinal as well as peripheral component. Any of these movements could be used as therapy.



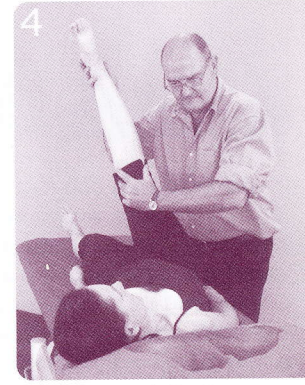
SLR



Hip adduction

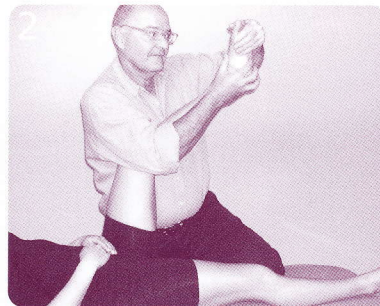
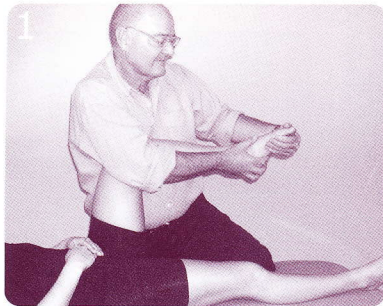


Hip medial rotation



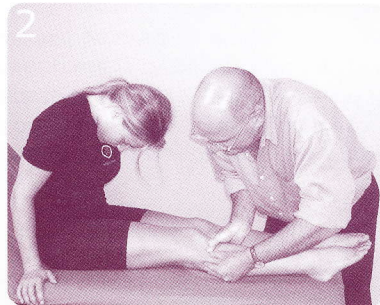
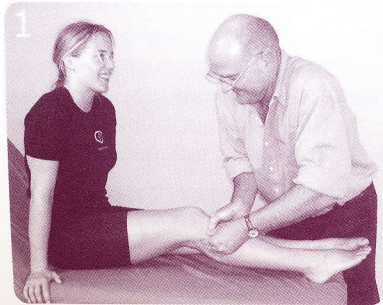
Spinal lateral flexion

In: HF/PF/IN > DF/EV Did: KE



Knee extension in hip flexion and ankle plantar flexion/inversion is a gentle way to mobilise the peroneal nerve for physical health issues anywhere along the nerve. In the technique example here, while the knee is being extended, the ankle is taken from plantar flexion/inversion to dorsiflexion and eversion for additional nerve mobilisation.

In: Slump LS/PF/IN Did: Sup TF mob + KE



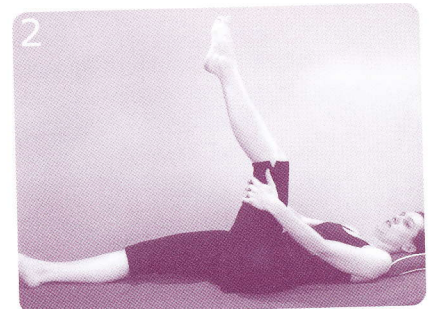
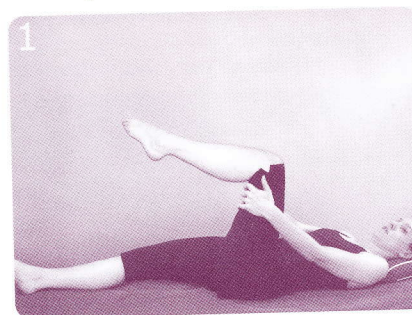
The slump based technique illustrated is a combination of superior tibiofibular joint mobilisation, plus knee extension, plus spinal flexion and note also that the patient's right foot is held into plantar flexion and inversion by her left foot. All these movements together would comprise a vigorous tensioner technique. Neck extension at the same time as knee extension would be a slider.

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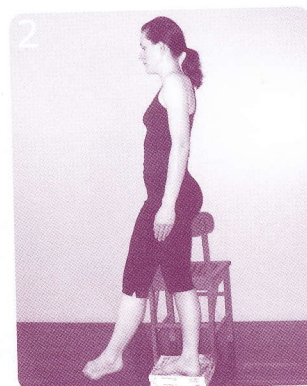
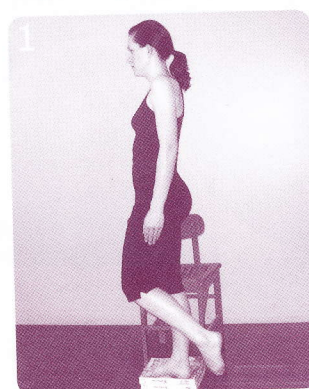
Peroneal nerve > self management > gentler movements

These techniques are examples of gentle ways to mobilise the peroneal nerves and roots. If a more gentle distracting movement is required, the patient could extend her neck during the knee extension or the 'swing through' in the leg swing technique.

In: HF/PF/IN Did: KE

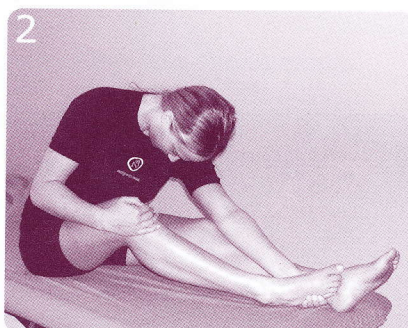
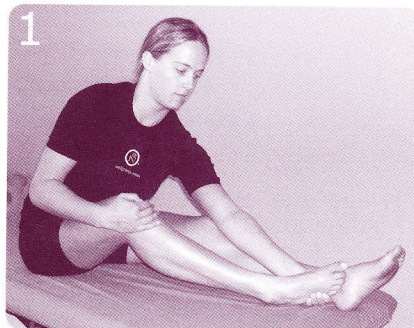


Leg swing toes curled under



These techniques are more vigorous than the ones on the previous page and may be applicable for mobile patients and patients with sports injuries involving the peroneal nerve such as a settling sprained ankle.

In: Slump LS/PF/IN Did: KE (sli/ten)



With the foot held in plantar flexion/inversion, knee extension and neck flexion makes a tensioner technique.



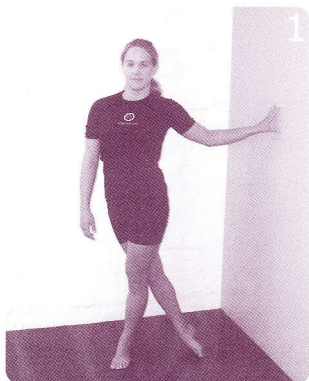
With neck extension, a slider technique is performed.

Standing mobilisation

Note how all the movement components which place load on the peroneal nerves and roots are used here.

The right hip is adducted and medially rotated and the knee is held extended by the patient's left leg.

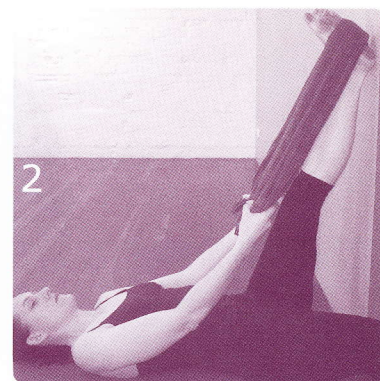
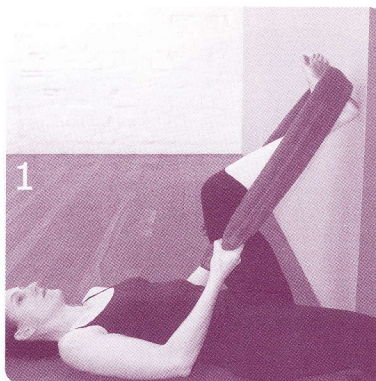
With foot in plantar flexion and inversion, spinal flexion including neck flexion allows a strong self mobilisation of the peroneal nerve and associated roots.



Illustrated here are two vigorous peroneal nerve based techniques.

Wall mobilisation

The key with the wall technique, where the patient lies in a doorway, is to make sure that the foot is maintained in plantar flexion and inversion via a towel or a strap.

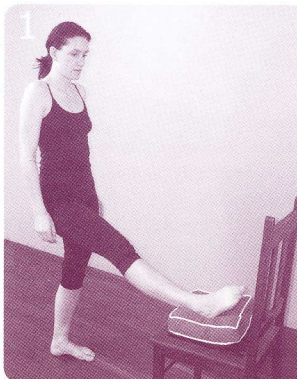


'Hamstrings stretch'

Focus on peroneal nerve

The 'hamstrings stretch' is a reminder that any muscle stretch will be likely to be a nerve mobilisation, particularly if the movements that place more load onto the nerve are included.

In this example, note in image 2 the addition of hip flexion, adduction and medial rotation, ankle plantar flexion and inversion and spinal flexion.



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Tibial nerve > anatomy and palpation

Palpable areas

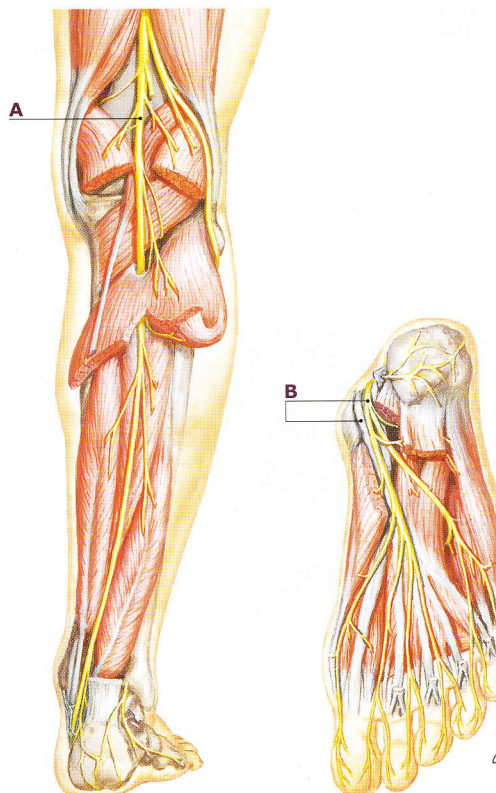
- A Posterior to the knee
- B Medial ankle (plantar nerves)

Common entrapments / syndromes

Plantar fasciitis
Heel spur
Recurrent hamstring injury
Piriformis area

The Sensitive Nervous System

Chapters 8, 11 and 15



DF/EV/SLR

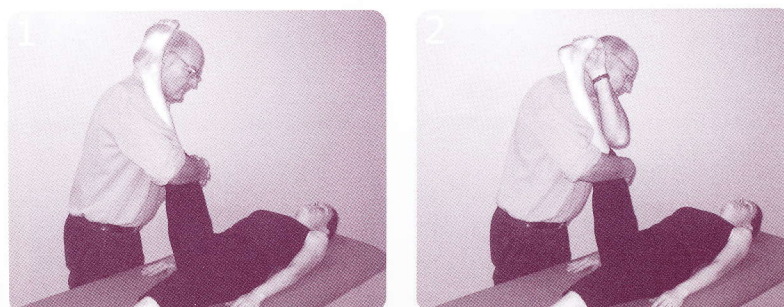


The foot is held in dorsiflexion, eversion and pronation. Straight Leg Raise is then performed with the therapist's arm on the shaft of the tibia.

The right leg can be flexed for a more sensitive problem.

In the reversal technique, the therapist's shoulder can be used.

Reversal SLR/DF/IN



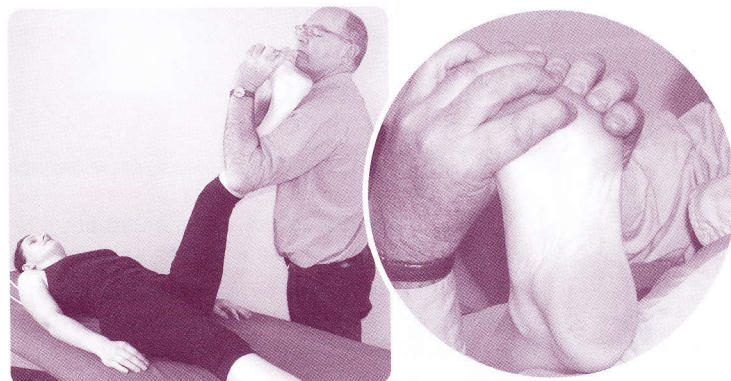
Tibial nerve > passive techniques

These techniques may be useful for *Morton's metatarsalgia*.

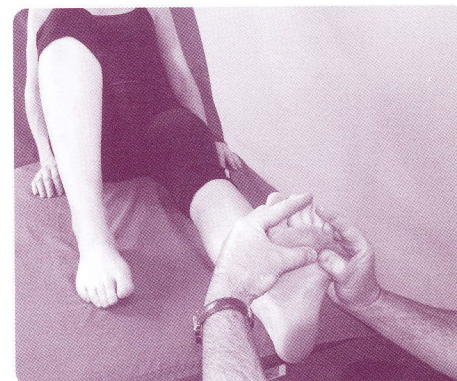
More comfort may be achieved with the therapist seated and the patient in a SLS position.

Try intermetatarsal splaying and antero-posterior movements (inset) and include extension of the toes.

In: SLR/DF/EV Did: IMT Mobilisation



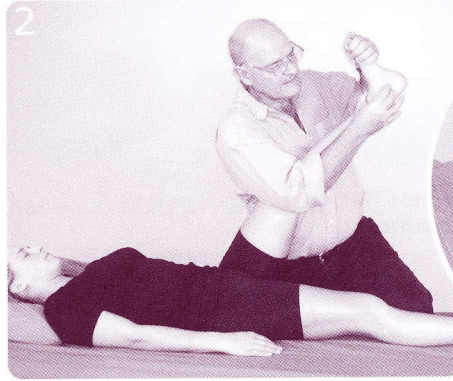
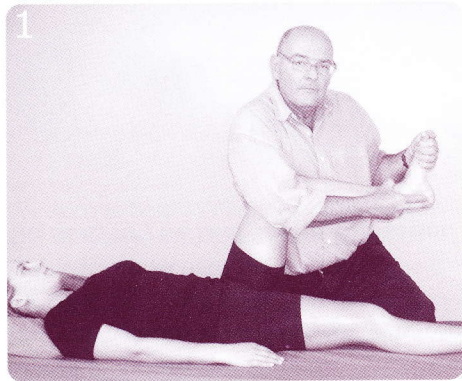
**In: Slump LS/DF/EV
Did: IMT Mobilisation**



In: HF/DF/EV Did: KE with nerve massage

This technique may be appropriate for neurogenic foot problems such as plantar fasciitis, particularly where there is swelling around the nerve at the medial ankle.

Most nerves can be massaged if there is no direct nerve injury and the nerve is not too sensitive.



1. HF/DF/EV

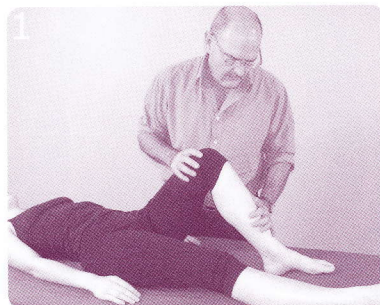
2. KE with nerve massage

© NOI

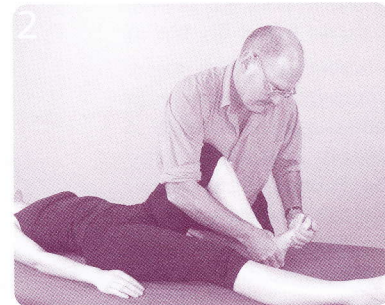
In: KF/DF/IN Did: KE/SLR

'Ultimate tibial mobilisation'

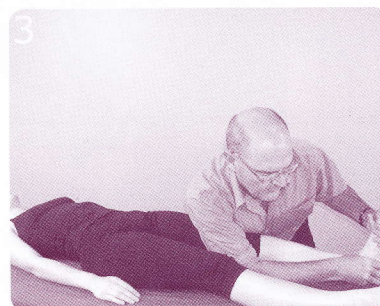
This technique uses order of movement principles to take up the nerve slack from the foot first.



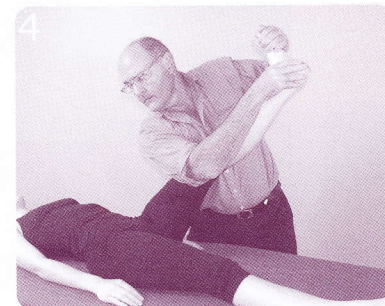
It is important to start with the knee flexed



Ankle dorsiflexion, eversion, pronation



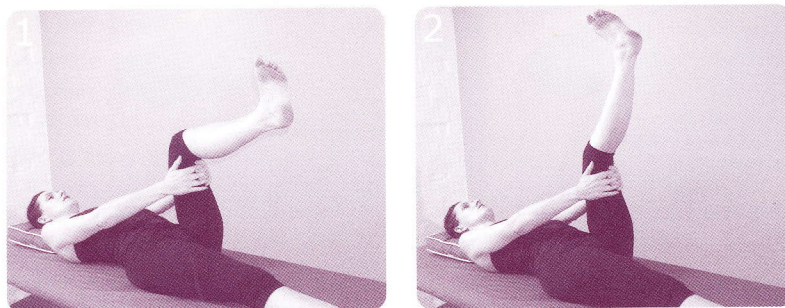
Knee extension



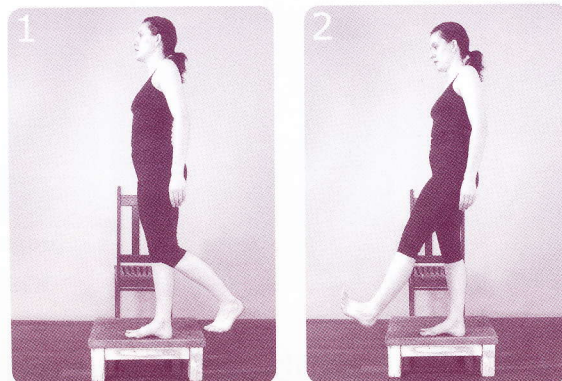
SLR. In the final position, any of the components could be mobilised.

© NOI

In: HF/DF/EV Did: KE
'Heel to the sky'



Leg swing heel
to floor

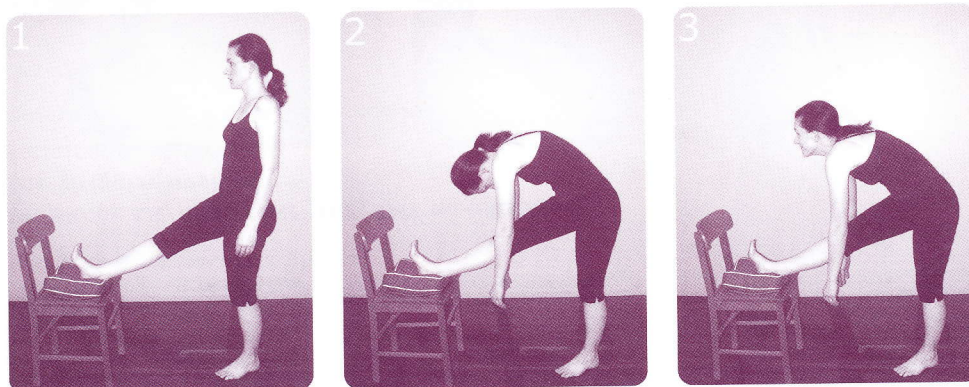


These are gentle movements, appropriate for a more acute or sensitive state involving the tibial nerve. If the patient focuses on pushing the heel to the sky it will encourage mobilisation of the tibial nerve and perhaps provide a distracting metaphor.

In the leg swing technique, poking the heel at the floor will create a similar nerve challenge.

© NOI

In: Stand/DF/EV Did: SP flex

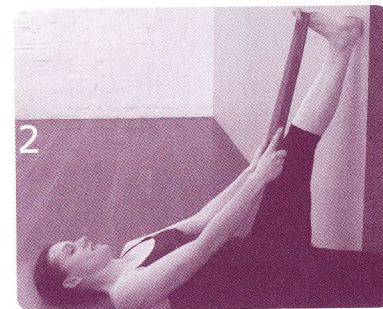
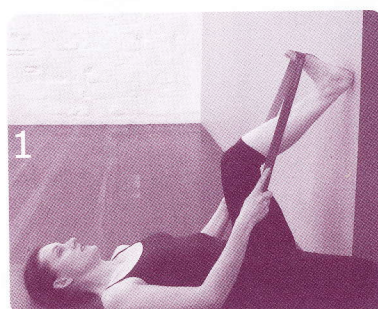


These are examples of more aggressive mobilisation techniques. Some of the peroneal nerve mobilisations could also be adapted for the tibial nerve.

Note the tensioner and the slider in the spinal flexion technique.

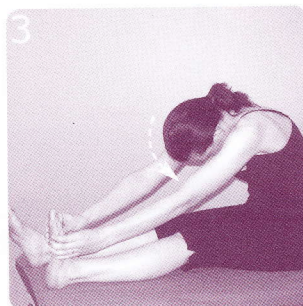
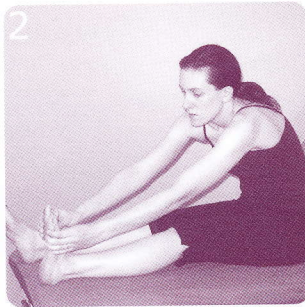
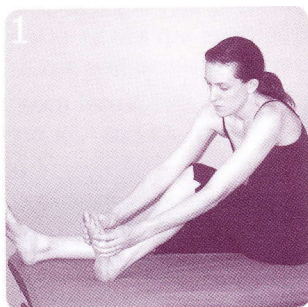
In: HF/DF/EV Did: KE + strap
'Wall work'

In the wall mobilisation technique, the key is to use the strap or towel to make sure that the foot is securely held in dorsiflexion, eversion and pronation.

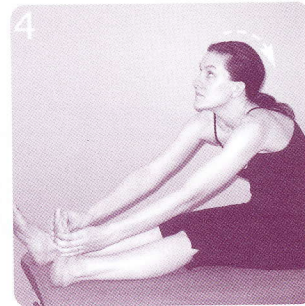


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In: Slump LS/DF/EV Did: KE (sli/ten)

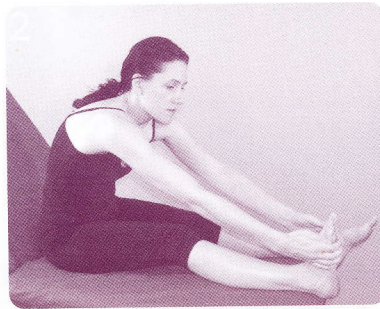
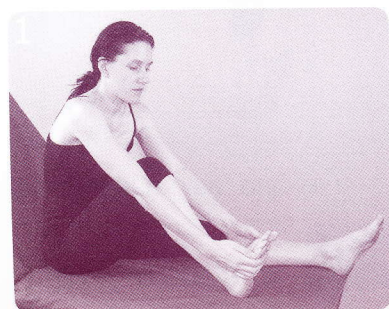


Tensioner



Slider

In: Slump LS/DF/EV/NF Did: IMT mobilisation
Toe wriggler in slump



Sural nerve > anatomy and palpation

Palpable areas

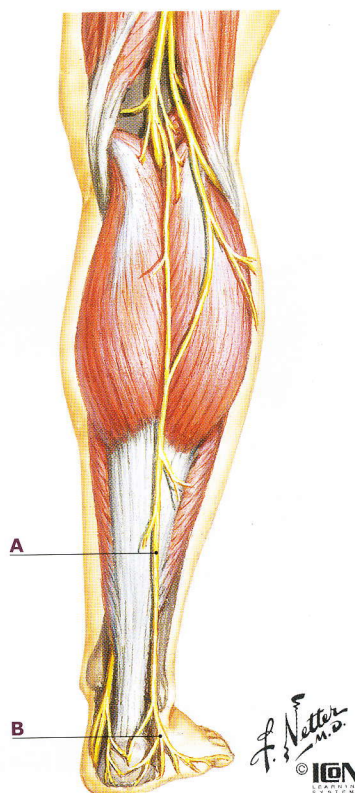
- A Lateral to the Achilles tendon
- B Distal to the fibula

Common entrapments / syndromes

- Recurrent ankle problems
- A component of Achilles tendonitis

The Sensitive Nervous System

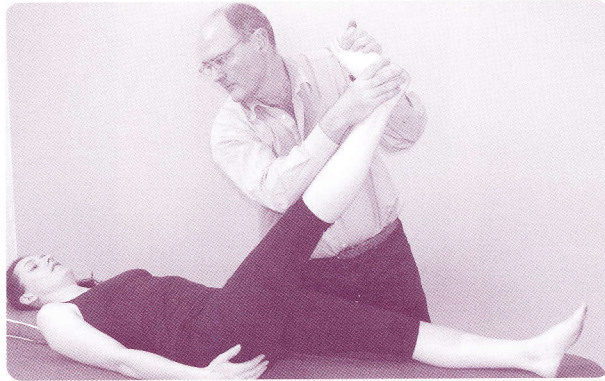
Chapters 8 and 11



DF/IN/SLR



The ankle is dorsiflexed and inverted and held firmly.



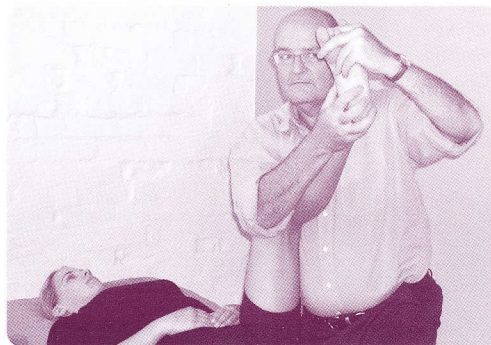
Therapist's forearm is on the shaft of the patient's tibia, maintaining knee extension during the SLR.

© NOI

Sural nerve > passive techniques

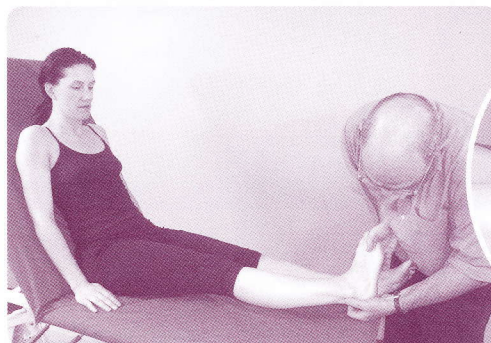
In: HF/DF/IN Did: KE

With the patient's hip in flexion and ankle in dorsiflexion and inversion, knee extension can be used to mobilise the nerve.

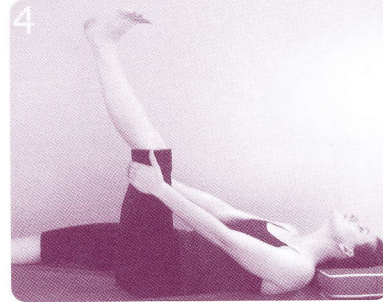
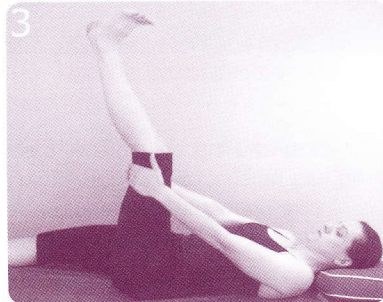
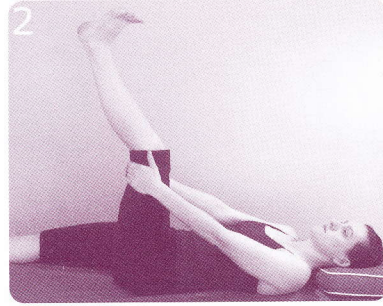
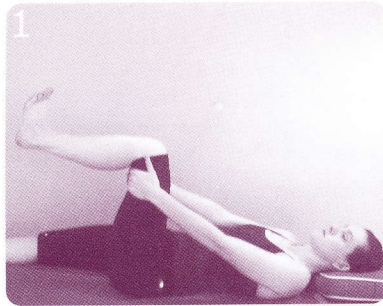


In: DF/IN Did: nerve massage

Massage techniques may be useful here, particularly for swelling around the lateral Achilles tendon. If appropriate, the nerve and its surrounding tissues can be massaged with the nerve in tension as in the SLS position depicted.



In: HF/DF/IN Did: KE (sli/ten)



Tensioner

Slider

The easiest way to self mobilise the sural nerve is to replicate the passive technique. Spend time ensuring that the foot is in dorsiflexion and inversion.

Adding neck flexion (3) provides a more aggressive movement and neck extension (4) allows a less aggressive and distracted large range movement.

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Femoral nerve > anatomy and palpation

Palpable areas

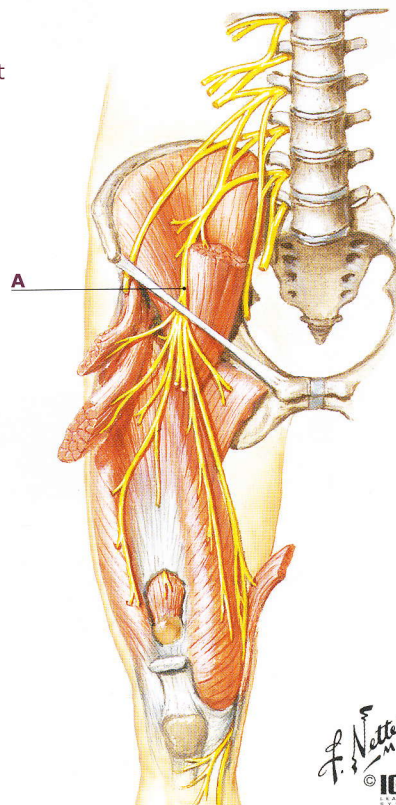
A May be palpable through tissue at the inguinal ligament

Common entrapments / syndromes

Pinch or hyperextension at the inguinal ligament
L2-3 root syndromes

The Sensitive Nervous System

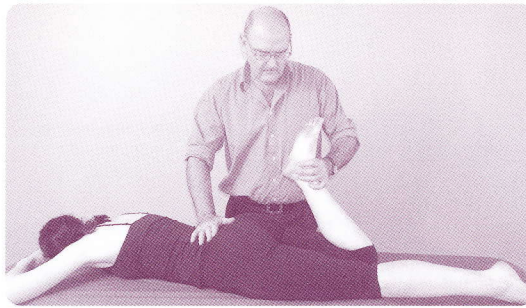
Chapters 8 and 11



F. Netter M.D.
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ILLUSTRATIONS

Prone Knee Bend (PKB)

The PKB is a crude test, as many structures (including the femoral nerve) are tested.

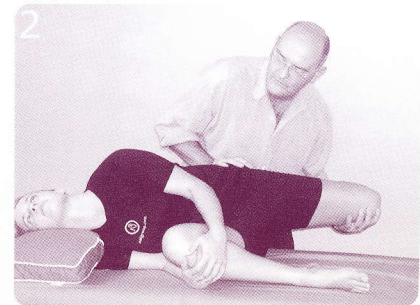
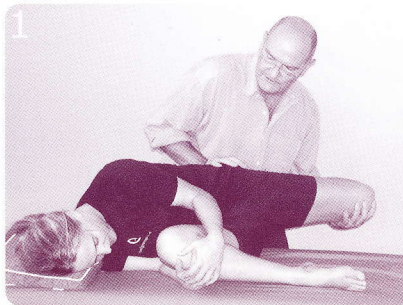
**Slump Knee Bend (SKB)**

The SKB allows a more refined testing than the PKB. For the left SKB, the patient's left knee should be around 90 degrees. Get the patient to hold her right knee in some, but not full, hip flexion and then extend the hip.

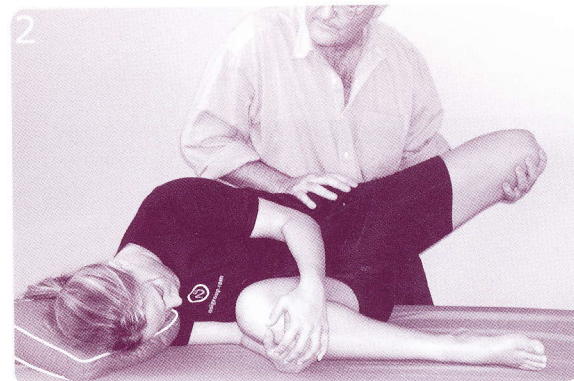
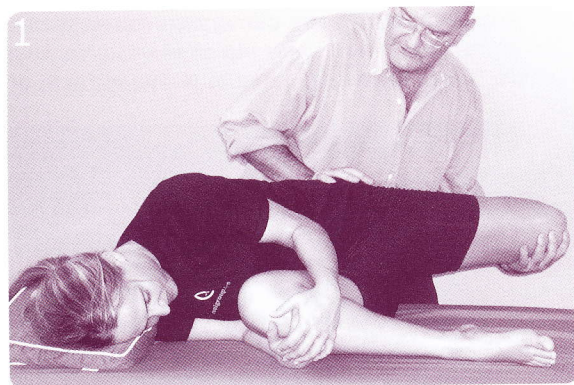
Use neck flexion/extension for structural differentiation.

For heavy legs, try performing the SKB with the test leg downside.

Hip lateral and medial rotation can be added to test groin nerves such as the ilioinguinal and iliohypogastric nerves.



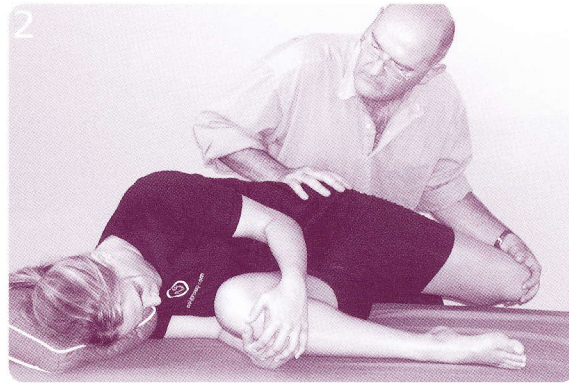
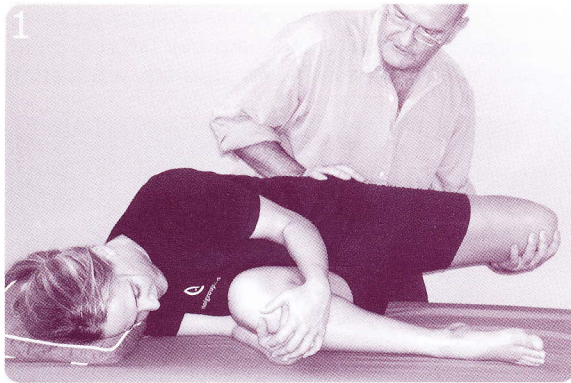
In: Slump SLY/KF/HE Did: HAb
Obturator test



To test the obturator nerve, use the Slump Knee Bend position and then abduct the hip (2). This could be an assessment and treatment technique for neurogenic components to groin and medial knee pain.

The neck could be used for structural differentiation.

In: Slump SLY/KF/HE Did: HAd
Meralgia test



To test the lateral femoral cutaneous nerve, which may be involved in the syndrome *meralgia paraesthetica*, the Slump Knee Bend position is used and then the hip adducted.

Any of these components could be used as therapeutic movements and/or if appropriate, structures around the nerves such as the L2-3 joints, the inguinal ligament and the anterior thigh fascia could be mobilised.

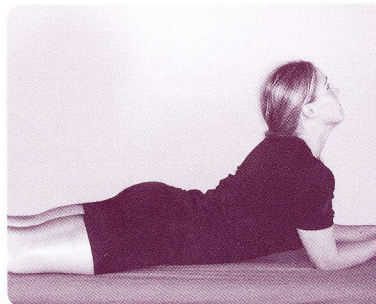
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Femoral nerve > self management

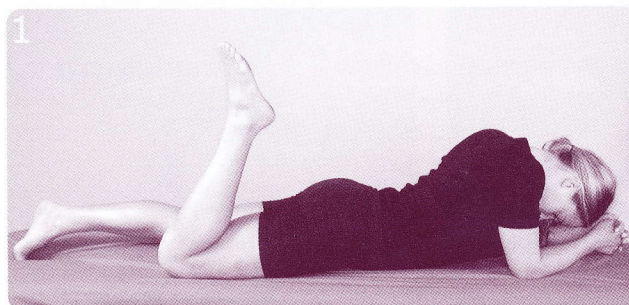
p25

Half Pushup

Half pushups are widely used in rehabilitation. The manoeuvre mobilises all anterior hip structures including the femoral nerve.

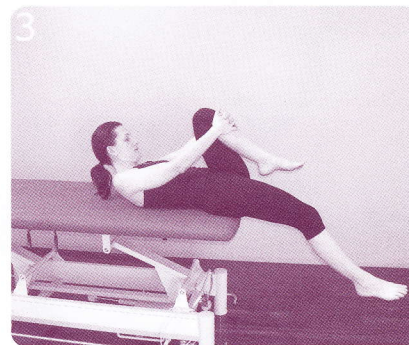
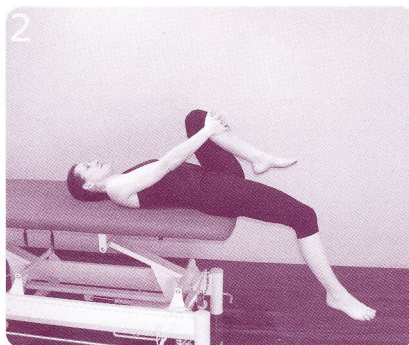


Half Pushup + neck sli/ten

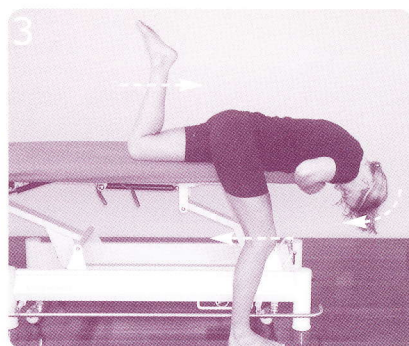
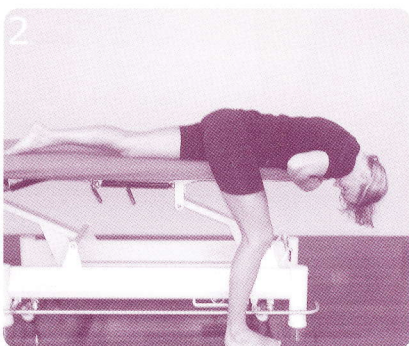
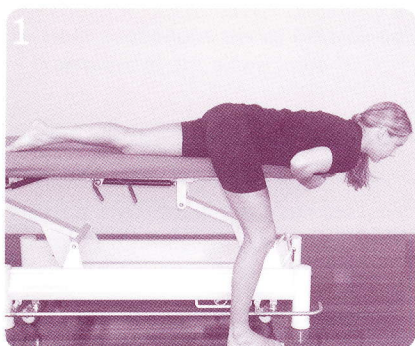


If the patient lies propped up on her elbows and flexes her head and the knee at the same time, this is a tensioner along the femoral tract even though the lumbar extension may slacken the system a little.

Neck extension and knee flexion would comprise a slider.

'Thomas test exercise'

An example of more aggressive self mobilisation for the femoral nerve complex. In the 'Thomas test exercise', anterior hip muscles will most likely limit the hip extension and knee flexion. If there is a neurogenic component, the addition of neck flexion may influence responses.

**'Hurdler stretch'**

Another example of more aggressive self mobilisation for the femoral nerve complex. In the 'Hurdler stretch' position, neck flexion, left knee flexion and right knee extension can be used simultaneously for an aggressive soft tissue and neural mobilisation.

Saphenous nerve > anatomy and palpation

p29

Palpable areas

- A** Infrapatellar branches on the head of the tibia
- B** Main saphenous nerve between gracilis and sartorius at the knee joint

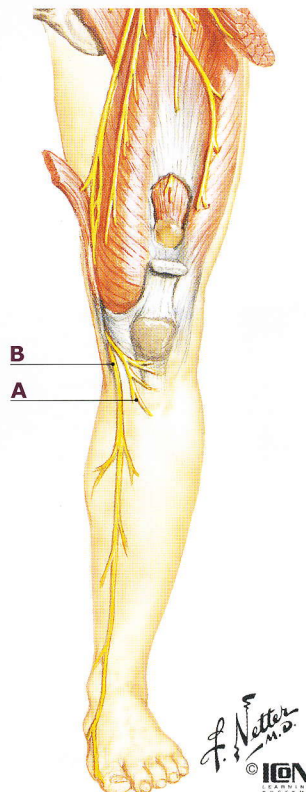
Common entrapments / syndromes

Post arthroscopy medial knee pain

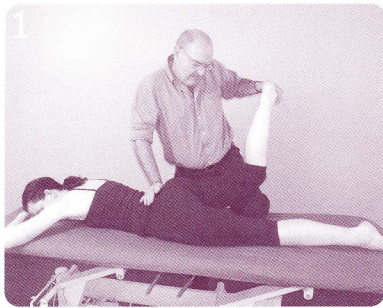
May be involved in knee medial collateral ligament injuries

The Sensitive Nervous System

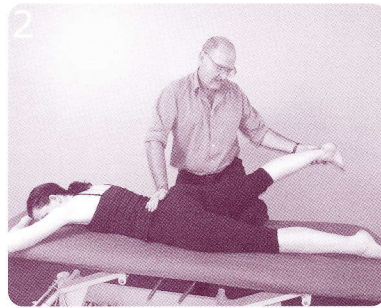
Chapters 8 and 11



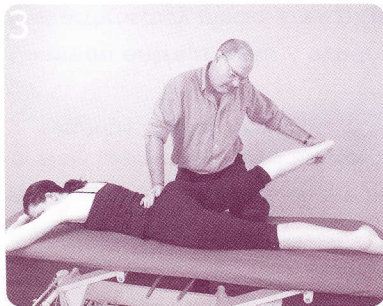
Prone/HE/HAb/KE/MR/DF/EV The saphenous test



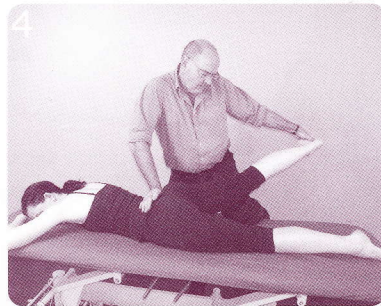
1 Hip extension and abduction



2 Knee extension



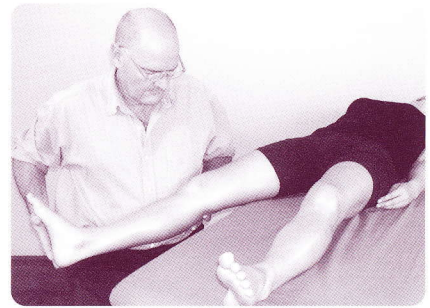
3 Hip lateral rotation



4 Ankle dorsiflexion eversion

Alternative position

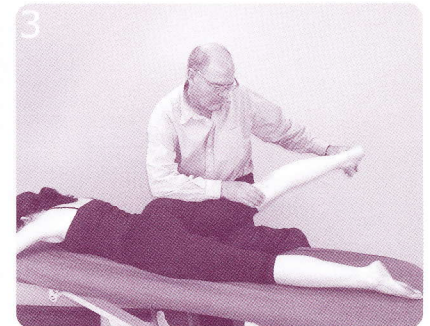
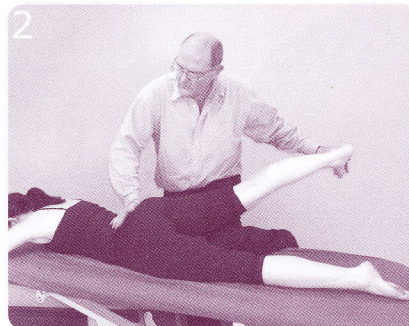
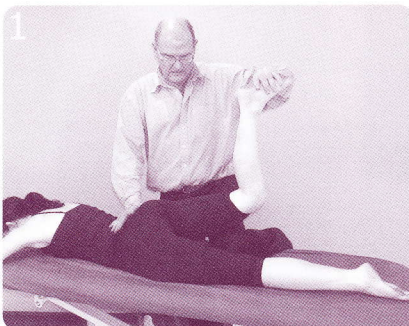
Patient in supine, therapist seated



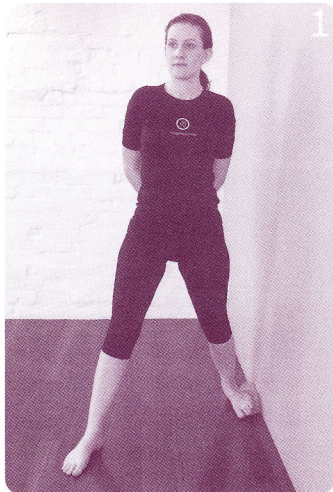
Saphenous nerve > passive technique

In: Prone/HE/HAb/MR/DF/EV Did: KE

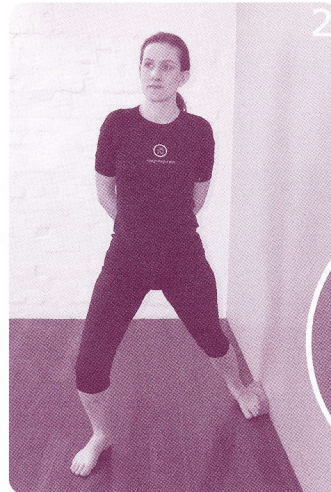
In the saphenous test position, knee extension is a useful way to mobilise the nerve complex. Massage techniques (3) could also be used.



The saphenous stretch



The patient stands with feet apart. To mobilise the left saphenous nerve, place right leg in front of the left. The left foot is in dorsiflexion and eversion.



By flexing the right knee the left saphenous nerve is self mobilised.



Median nerve > anatomy and palpation

Palpable areas

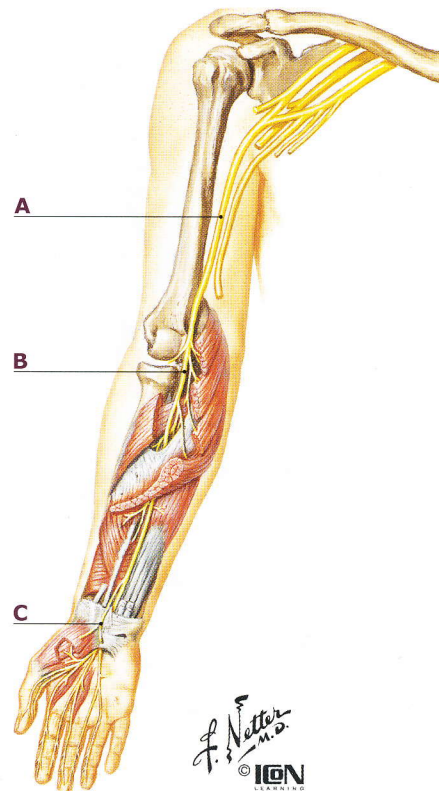
- A** Upper arm
- B** Medial to the biceps tendon
- C** Indirectly at the carpal tunnel

Common entrapments / syndromes

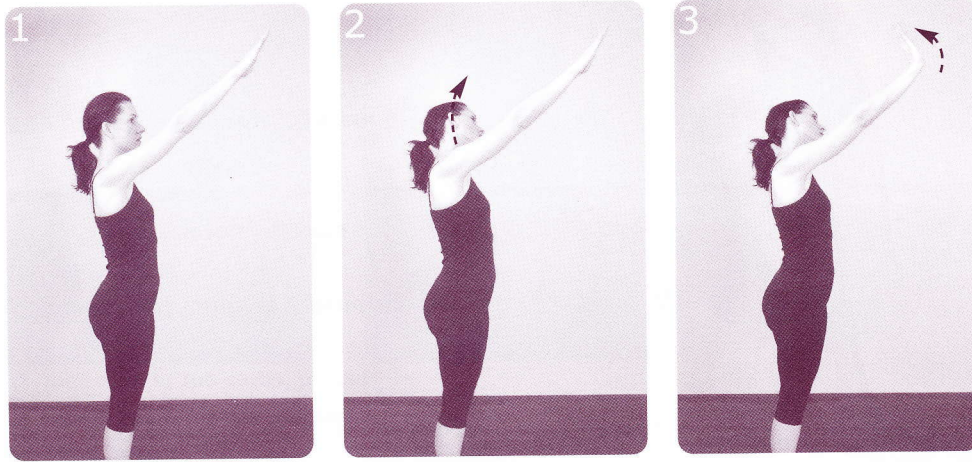
Carpal tunnel syndrome
Post Colles' fracture symptoms
C5-6 nerve root

The Sensitive Nervous System

Chapters 8, 12 and 15



This active quick test is an example of structural differentiation. If there are symptoms on shoulder elevation that are made worse by either neck lateral flexion away from the test side and/or wrist extension, then the clinical inference is that those symptoms are from a neurogenic source, perhaps the median nerve and/or its roots. If the therapist stabilises the shoulder, more refined testing is possible.

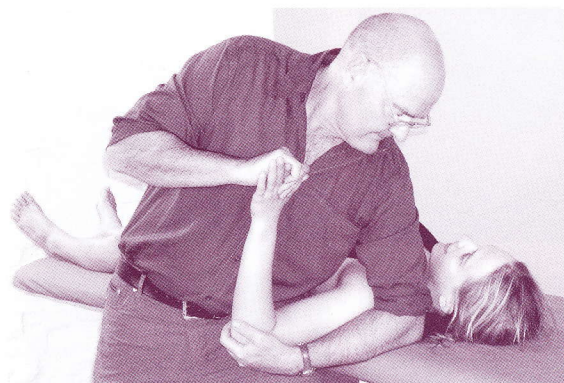


ULNT1 (See stage by stage description on next page)



ULNT 1

1. Starting position. Note patient's thumb and finger tips supported, plus some of the weight of the arm taken on the therapist's thigh.
2. Shoulder abduction to symptom onset, or tissue tightness, or approximately 100 degrees.
3. Wrist extension. Make sure the shoulder position is kept stable.
4. Wrist supination, again making sure that the shoulder position is kept stable.
5. Shoulder lateral rotation, to symptom onset or where the tissues tighten a little.
6. Elbow extension to symptom onset.
7. Neck lateral flexion away, making sure it is whole neck and not just the upper cervical spine.
8. Neck lateral flexion towards. This should ease evoked symptoms.

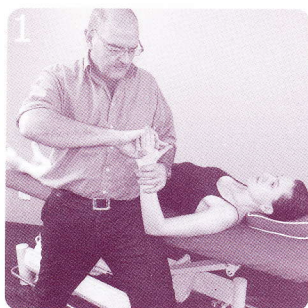
ULNT1 Alternative position

The alternative position shown uses the therapist's shoulder rather than their fist. From the starting position shown, the entire test can be performed. It is a comfortable and very supportive position for anxious patients. It is also a useful way to provide passive movement techniques to patients.

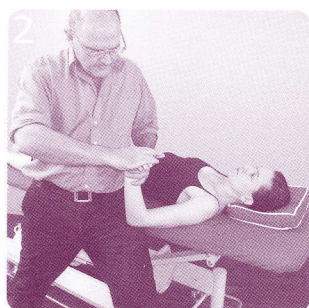


Median nerve > therapist's assessment

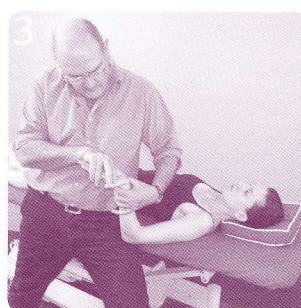
ULNT1 Reversed This reversal of the ULNT1 is an example of using the order of movement principles. Such a technique may be appropriate for a median nerve based problem such as carpal tunnel syndrome.



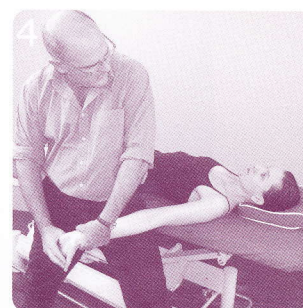
Starting position



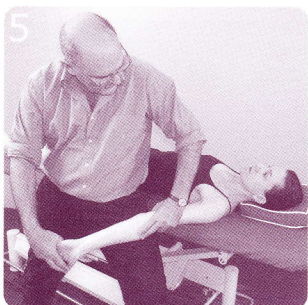
Wrist extension



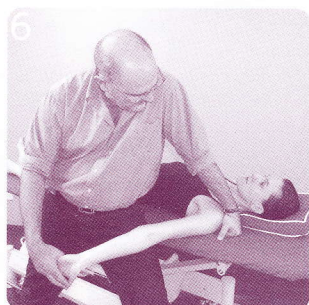
Wrist supination



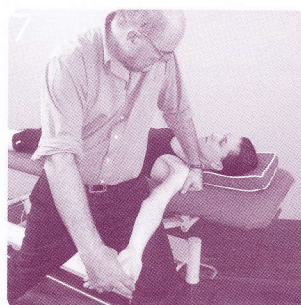
Elbow extension, hold wrist position securely



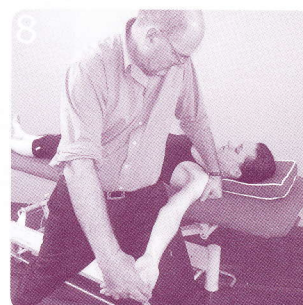
Whole arm lateral rotation



Block the shoulder girdle from elevating



Careful shoulder abduction using the therapist's thigh



Add cervical flexion or lateral flexion

ULNT1 Reversed: index finger first

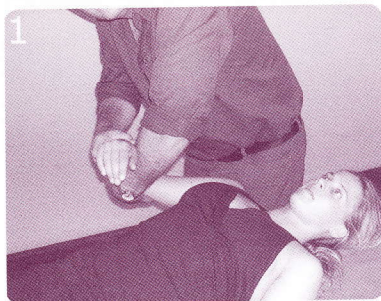
The reversed ULNT1 can also be performed by starting with one digit and then adding the other components. Such an assessment and treatment technique may be appropriate for a patient with a persistent digital nerve problem.



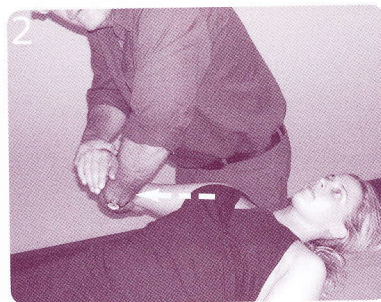
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Median nerve > therapist's assessment

ULNT2



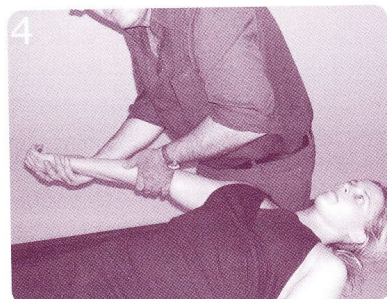
1 Patient has her shoulder girdle just over the side of the bed



2 Shoulder girdle depression (via the therapist's thigh) to symptoms or where the tissues tighten a little



3 Elbow extension



4 Whole arm lateral rotation, keeping shoulder girdle depressed



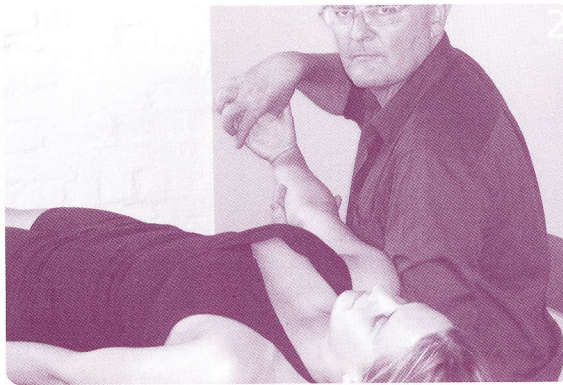
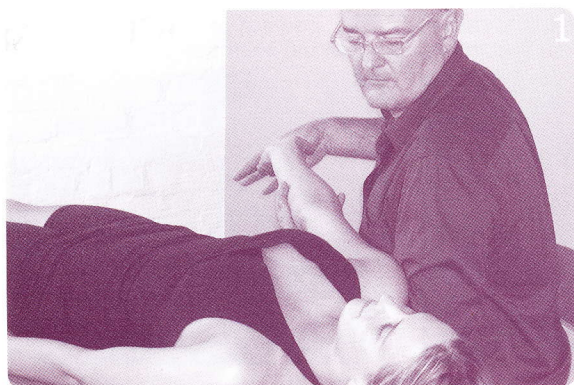
5 Wrist and finger extension (note suggested grip in the inset)

Structural differentiation can be preformed by elevating the shoulder girdle a little, or if there are shoulder/neck symptoms, the wrist flexion can be released.

ULNT2 Seated position

The ULNT2 can be performed with the therapist sitting. Many patients and therapists prefer this as the arm can be very well supported and it is easier to see the patient's face.

In image 2, structural differentiation is performed via wrist flexion to differentiate the origin of shoulder area symptoms.



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Median nerve > passive techniques

p41

Here are two examples of the slider and tensioner movements for the median nerve.

ULNT2 Sli/ten

In the seated position, if the wrist is flexed and the shoulder girdle depressed, as in the image, this comprises a slider movement.

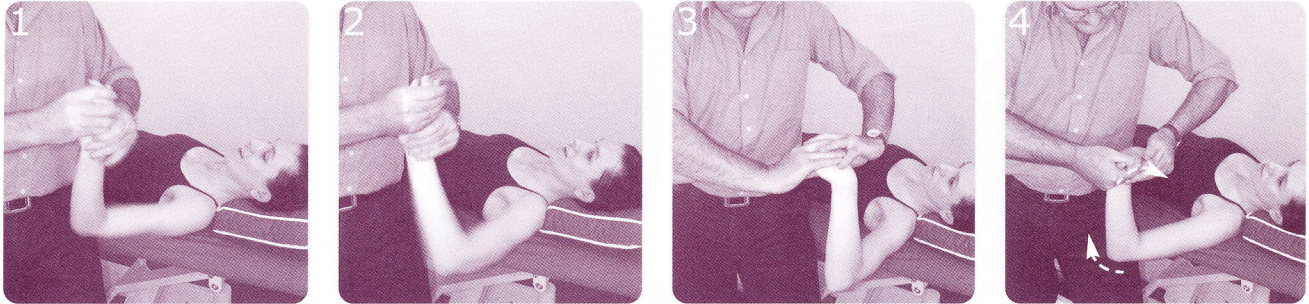
**ULNT1 Sli/ten**

When there is neurogenic problem, during the ULNT1 test, the patient's shoulder girdle will often protract, thus avoiding some of the tension on the nervous system. At the moment of protraction, if wrist flexion is added, then a slider will be performed. This allows a gentle mobilisation as well as a way of unlearning useless motor patterns.



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'Nanna arm wobble'



'Nanna arms' are the floppy bits many people get under their upper arm, especially as we get a bit older. The aim of this passive technique is to make the arm 'flop'. If the patient is relaxed, while the wrist goes into flexion the shoulder adducts.



In: ULNT1 Did: GH mobilisation

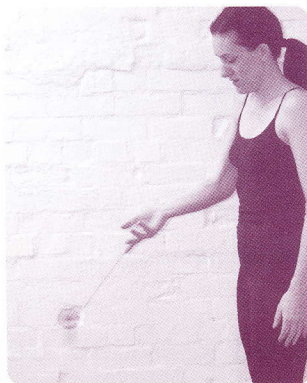
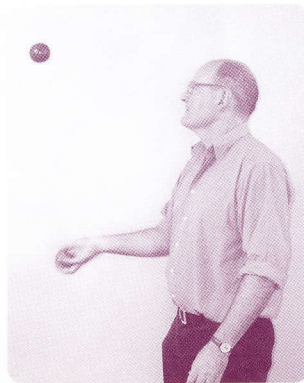


This is an example of performing a joint mobilisation while the nerve is in some tension. There may be a stiff joint accessory movement which can be mobilised while the nerve is in some tension. Such a patient would have joint and neural tissue physical health issues.

Technique in more shoulder abduction.

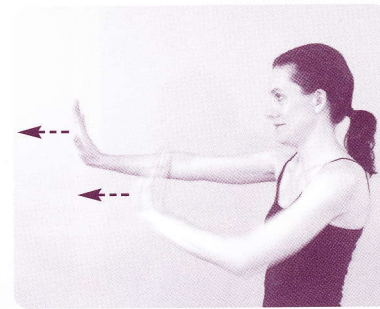
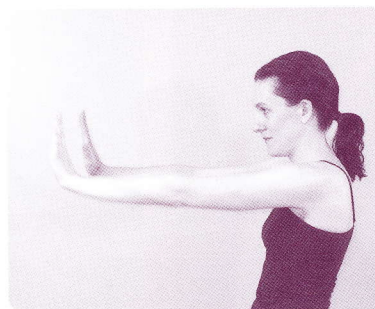
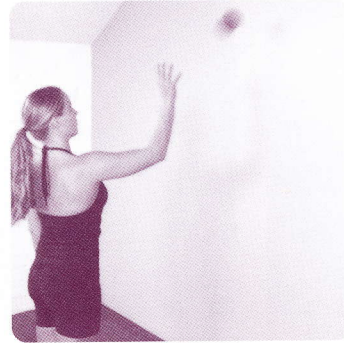
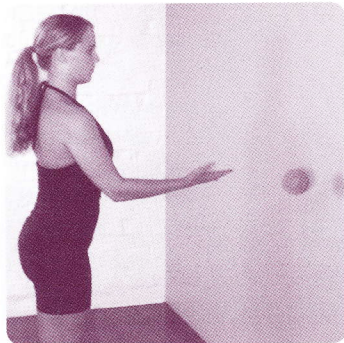
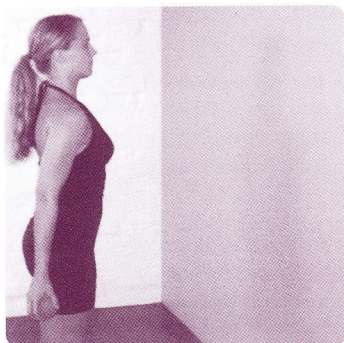
Note how further tension is placed on the nerve, by asking the patient to extend her wrist.

This series of gentle self mobilisation techniques uses functional and fun movements and metaphors. 'Balloon patting', 'watch the watch' (place watch on ventral side of wrist) and using a yoyo encourage the supination and elbow extension parts of the ULNT1. Attempts at juggling provide a similar nerve mobilisation.

Balloon patting**'Watch the watch'****Yoyo****Juggling**

Median nerve > gentler movements

'No more dishes' and the ball throwing progression are more aggressive mobilisers, but still functional and fun. Ball throwing can be progressed from underhand to overhand throwing.

'No more dishes' (after Barb Beatty)**Ball throwing progression**

With imagination, knowledge of neuroanatomy, and use of metaphors, a series of functional mobilisation techniques for the median nerve can be constructed. Get the patient to 'buzz' during 'busy bee', note that the finger and wrist stretches are quite vigorous for neural tissue in the hand and wrist.

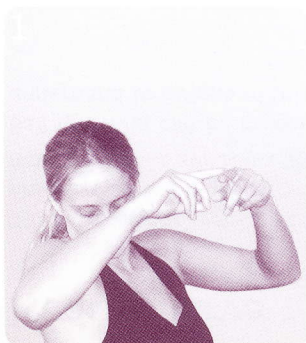
Crawling is a strong functional median nerve mobiliser and note how balancing creates large range slider movements similar to a ULNT2 for the median nerve.

For 'free the bird' get the patient to imagine they are holding a small bird and then to let it go. Now where is that frisbee?

'Busy bee'



'Finger stretch'



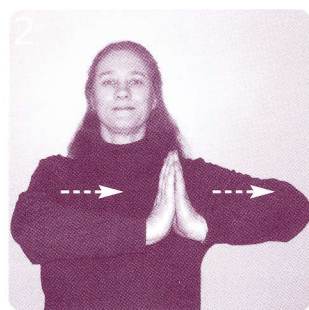
Wrist stretch



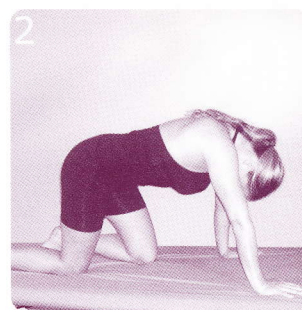
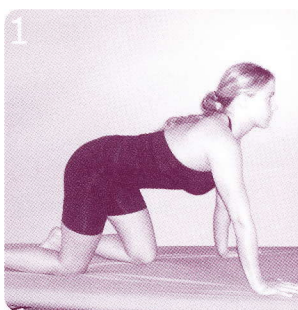
'Rock around the clock'



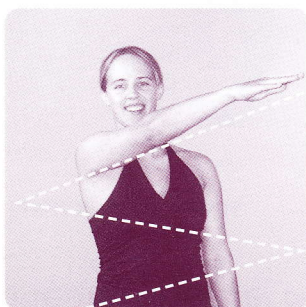
'Sawatdika'



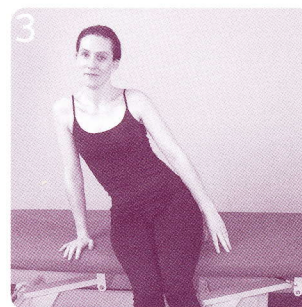
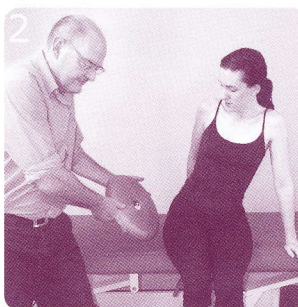
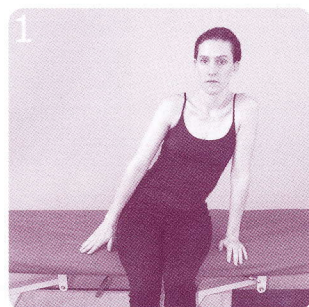
Crawling



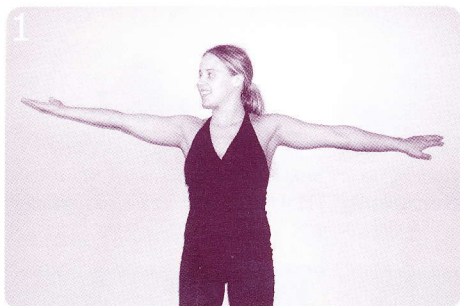
'Zorro'



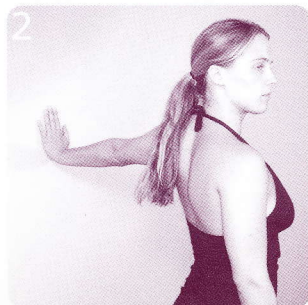
Balancing acts



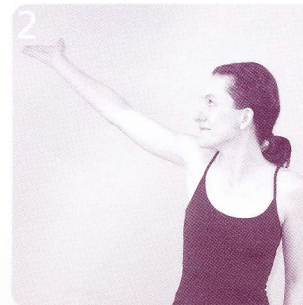
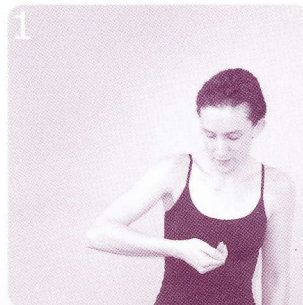
Look at your hands



Wall stretch



'Free the bird'



Ulnar nerve > anatomy and palpation

Palpable areas

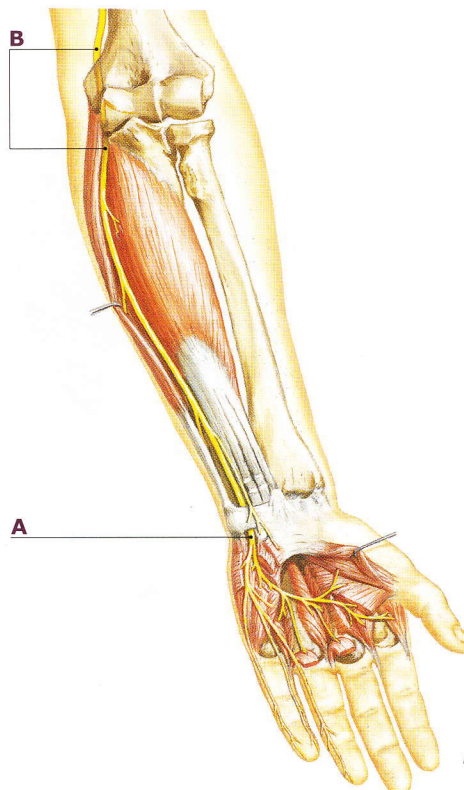
- A** Pisiform area at the wrist
- B** At the elbow and in the upper arm

Common entrapments / syndromes

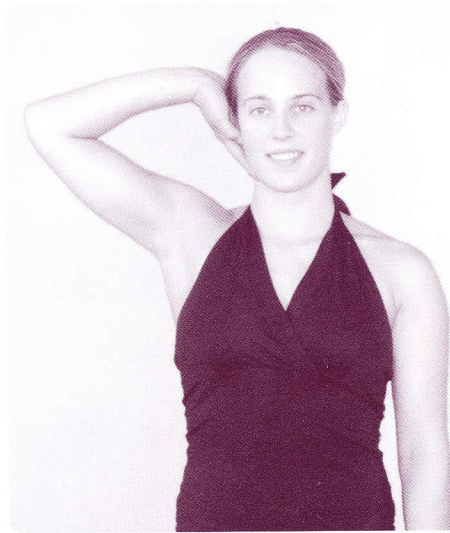
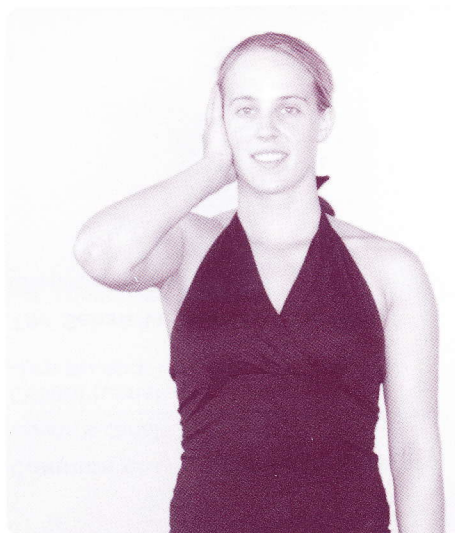
Guyon's canal
Cubital tunnel

The Sensitive Nervous System

Chapters 5, 8 and 12



F. Netter M.D.
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LEARNING SYSTEMS



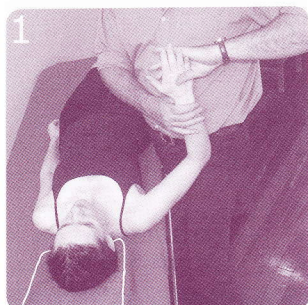
Ask the patient to put her hand on her ear and then, keeping the hand on the ear, lift the elbow up.

For most patients with ulnar nerve or root based problems this movement, or part of the movement, will be sensitive in the ulnar distribution.

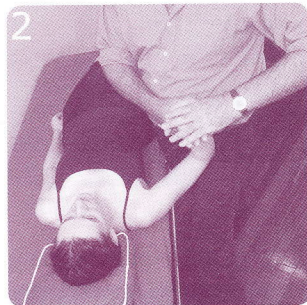


Ulnar nerve > therapist's assessment

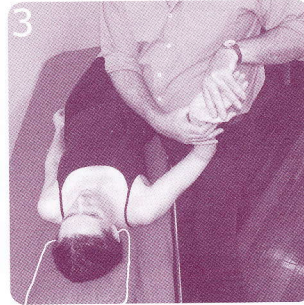
ULNT3 From wrist first



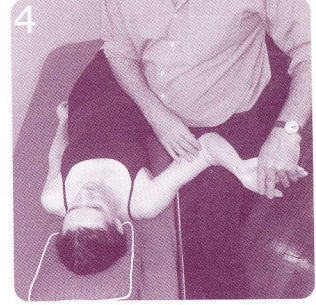
Starting position - the patient's elbow rests on the therapist's hip



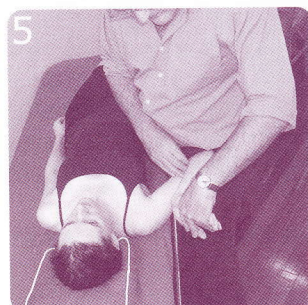
Wrist and finger extension, ensure 4th and 5th fingers are extended



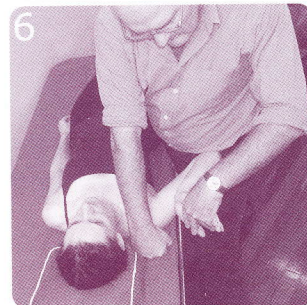
Pronation



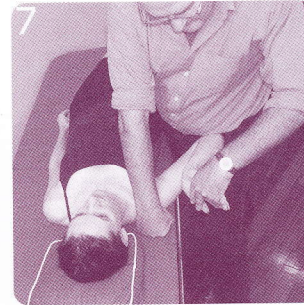
Shoulder lateral rotation, ensuring wrist position is maintained



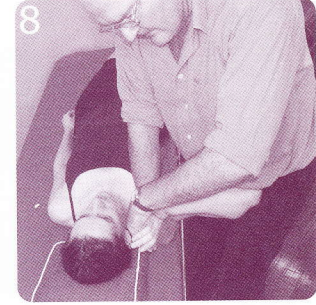
Elbow flexion



Block shoulder girdle elevation by pushing fist into the bed

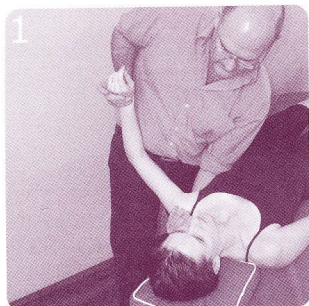


Shoulder girdle depression if required

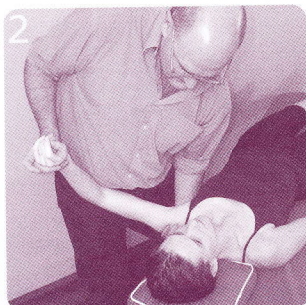


Shoulder abduction; neck lateral flexions can be added if required

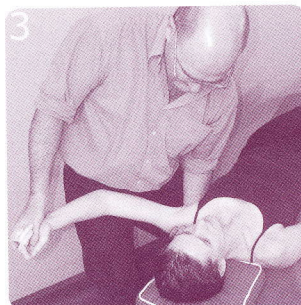
ULNT3 From shoulder first



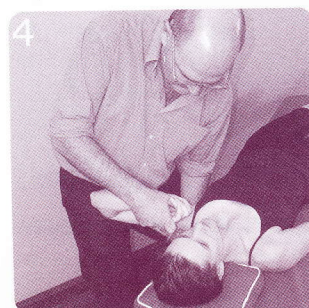
1 Starting position. With hand under patient's scapula depress shoulder girdle



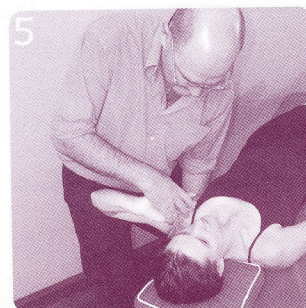
2 Shoulder abduction



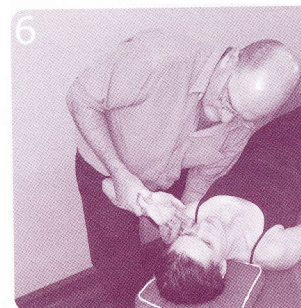
3 Lateral rotation of shoulder



4 Elbow flexion



5 Wrist and finger extension



6 Forearm pronation

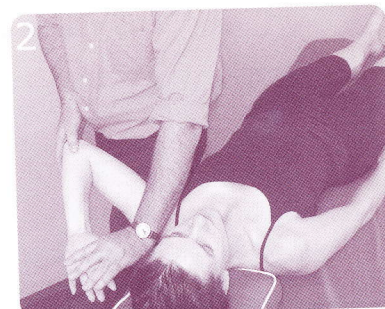
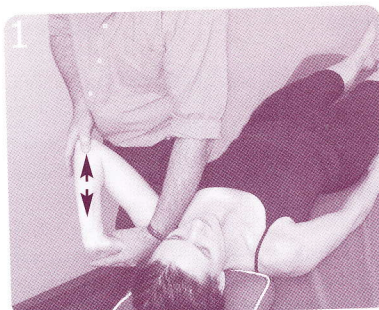
© NOT

Ulnar nerve > passive techniques

In: ULNT3 Did: massage cubital tunnel

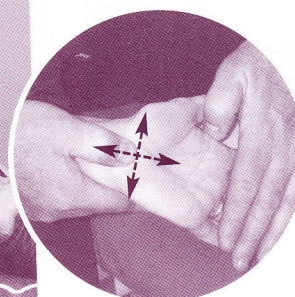
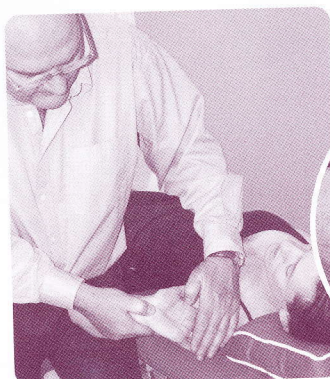
These are examples of massage techniques in neural load positions.

Note how the ulnar nerve in the cubital tunnel is massaged more aggressively with the wrist in extension (1) and then more gently with the wrist in flexion (2). The massage and the wrist movements could be combined.

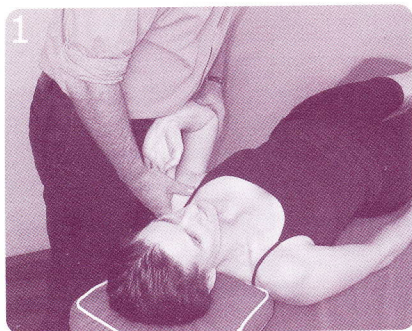


In: ULNT3 Did: pisiform mobilisation

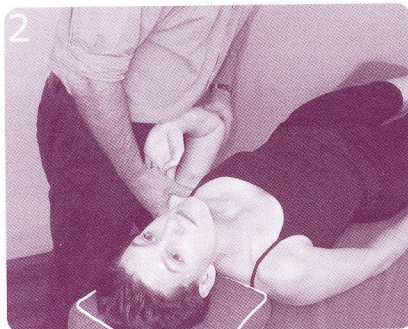
The pisiform mobilisation in ulnar nerve load is an aggressive technique. It may be relevant for a patient with persistent little finger problems after a wrist injury.



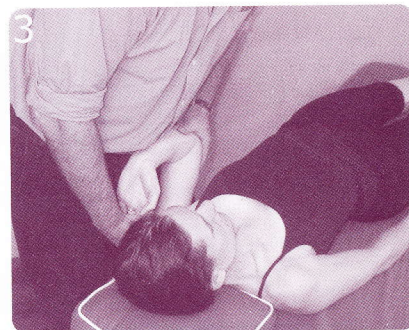
In: ULNT3 Did: Sli/ten



In 1, a tensioner is performed as the shoulder girdle is depressed while the ulnar nerve is loaded.



The patient's neck is extended as the shoulder girdle is depressed, making a slider technique.



With neck flexion, this is a more aggressive tensioner technique.

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Ulnar nerve > self management > gentler movements

p55

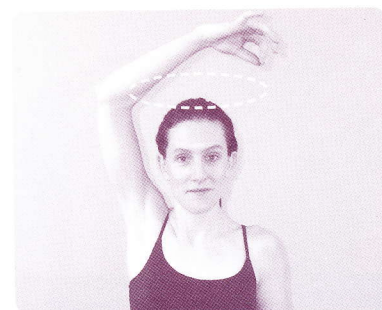
'Don't listen'



'Face massages'



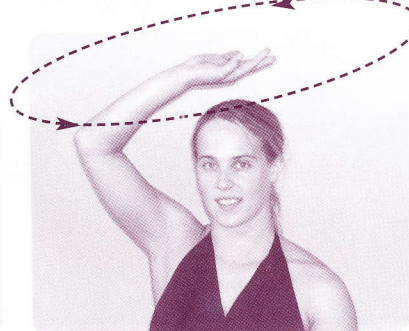
'Make a halo'



'Smoking'

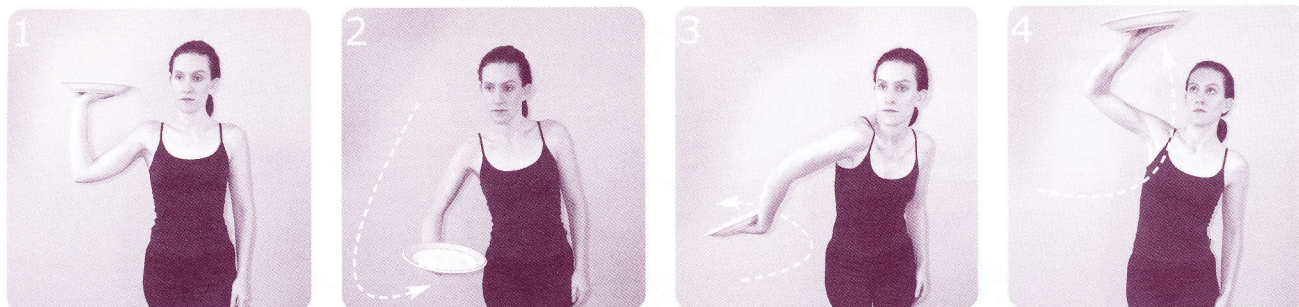


'Yahoo!'



These are examples of gentle functional movement for the ulnar nerve and its brain representations. The metaphors provide a distraction. Be creative.

'Plate exercise'



Ask your patient to imagine they have a glass of wine on the plate and then do the exercise as shown in the images.



Some examples of stronger mobilisation exercises for the ulnar nerve.

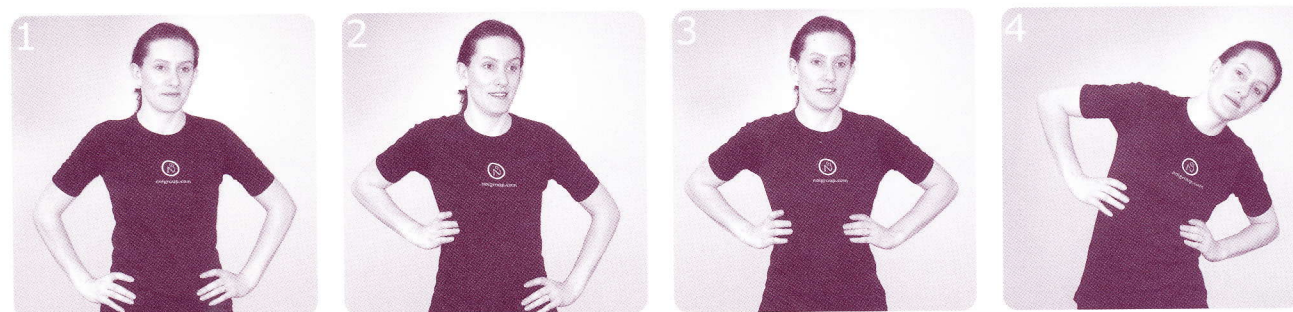
'Dry the back'



'Sunglasses'



'Crawl to the pits'



Radial nerve > anatomy and palpation

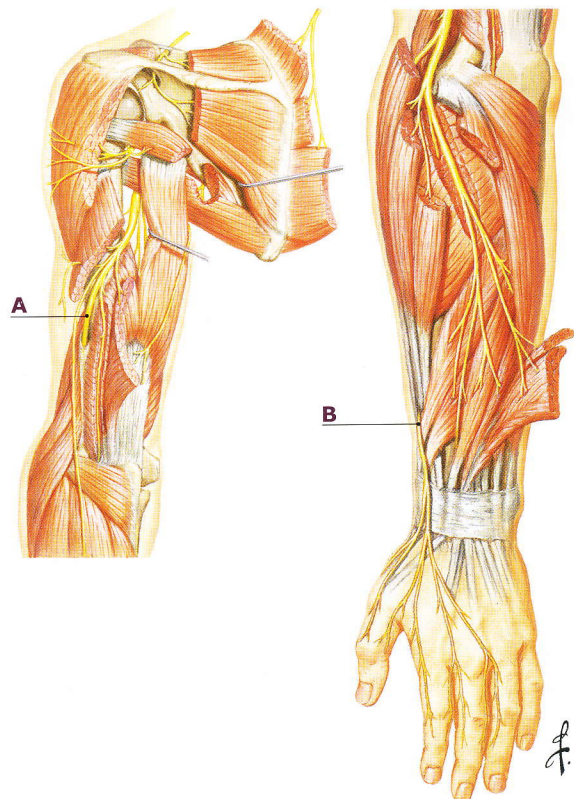
p59

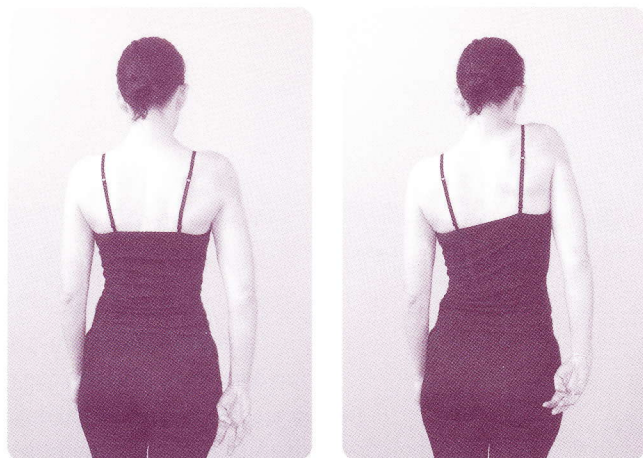
Palpable areas

- A** Mid humerus
- B** Radial sensory nerve on the lateral aspect of the forearm

Common entrapments / syndromes

- De Quervain's tenosynovitis
- Supinator muscle (tennis elbow)
- Post humeral fracture pain
- C5-6 root syndromes





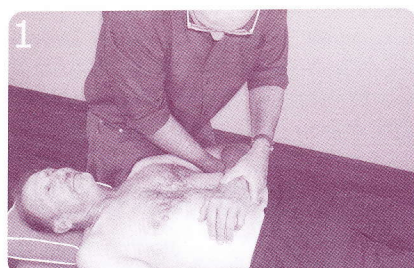
Ask the patient to let their arm hang by their side, then make a fist holding their thumb, then extend the elbow, then point the thumb away from the body (internal rotation) and depress the shoulder. A few degrees of shoulder extension may sensitise the test. Elevation of the shoulder girdle provides an easy way to structurally differentiate.

© NOT

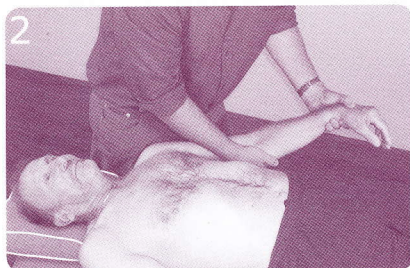
Radial nerve > therapist's assessment

p61

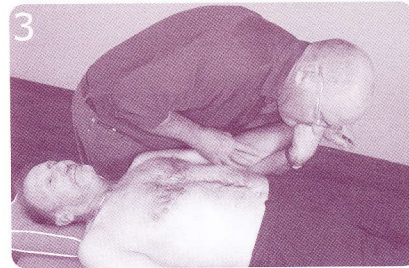
ULNT2 (radial)



The patient lies with their shoulder just over the side of the bed, the therapist uses his thigh to carefully depress the shoulder girdle



Elbow extension



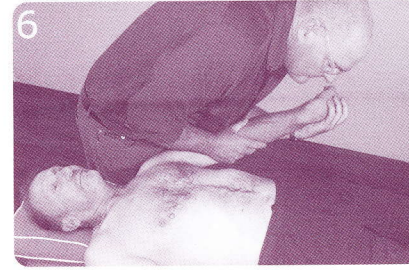
Notice how the therapist has brought his left arm 'around' to grasp the patient's wrist in order to medially rotate the whole arm



Whole arm medial (internal) rotation



Wrist and thumb flexion can be added. Leave the fingers out as the extensors will be too tight

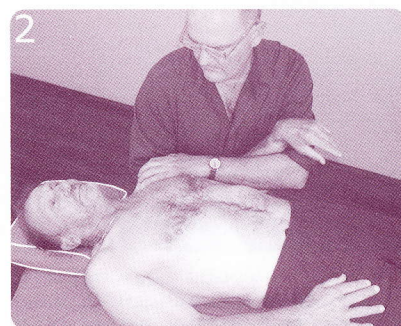
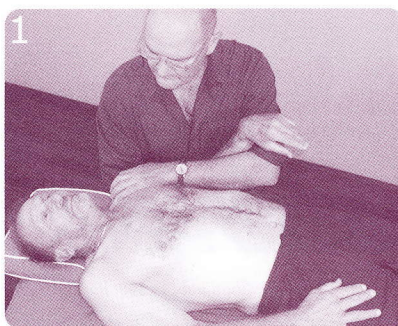


Adding a few degrees of shoulder abduction will sensitise the test and elevation of shoulder girdle will provide structural differentiation

ULNT2 (radial) Seated variation

Some therapists prefer to assess the radial nerve in sitting, particularly if the patient is anxious and sensitive. The patient's arm can be well cradled and supported. This is also a good position to perform passive techniques.

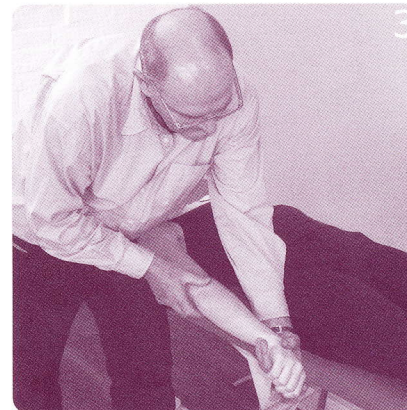
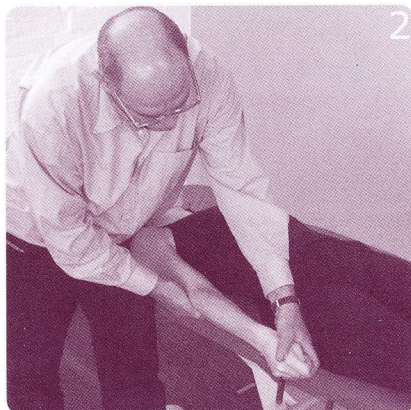
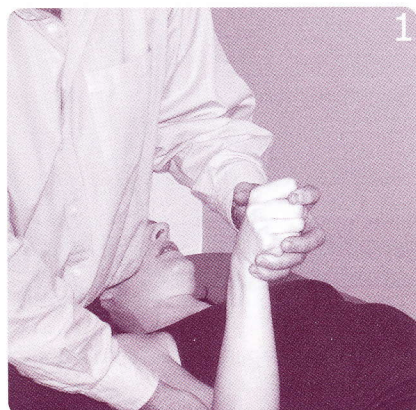
1. The arm is well supported in the starting position
2. Shoulder girdle depression
3. Whole arm medial rotation
4. Wrist flexion



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**ULNT2 (radial) From wrist first**

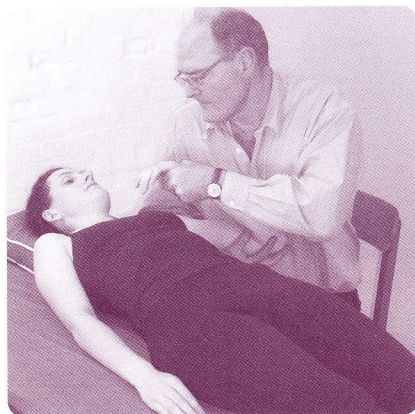
This may be appropriate for persistent problems on the lateral aspect of the wrist. Using order of movement principles, wrist and finger flexion plus ulnar deviation (1), then elbow extension (2), arm medial rotation (3) loads the radial nerve from the wrist first.



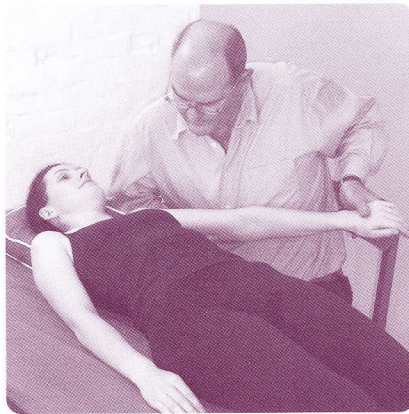
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In the seated position there are plenty of opportunities for gentle passive techniques. If you get the patient to point to their nose while you gently depress the shoulder girdle, this forms a gentle slider. Be creative.

'Gentle radial sliding'



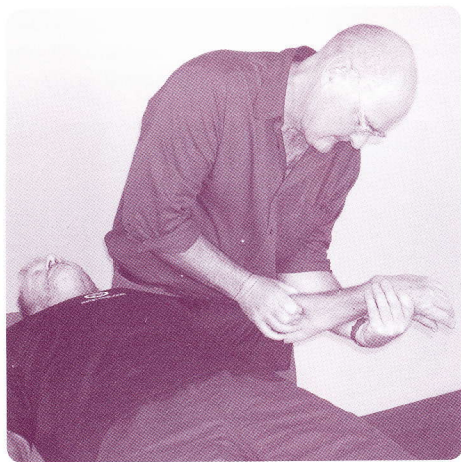
'Whole arm rotations'



© NOI

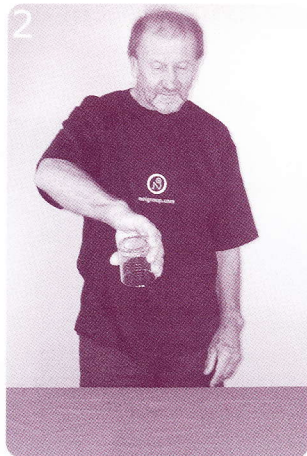
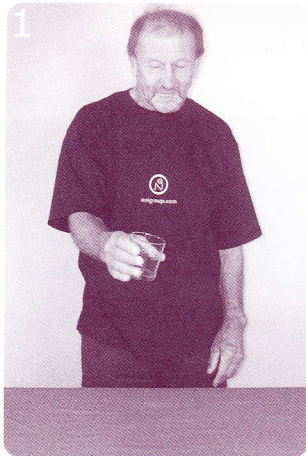
Radial nerve > passive techniques

In: ULNT2 (radial) Did: Rad head and soft tissue mobilisation

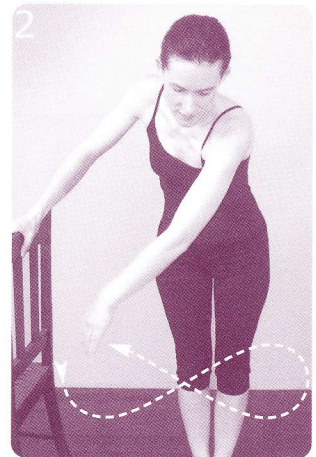
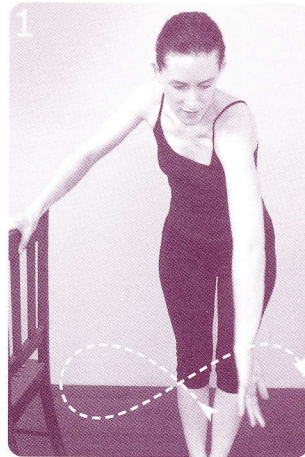


Once the ULNT2 radial nerve position is maintained, a variety of techniques are available. The radial head could be mobilised or soft tissue stretches performed. Some of these may be useful for tennis elbow which has strong local tissue components.

'Pouring water'

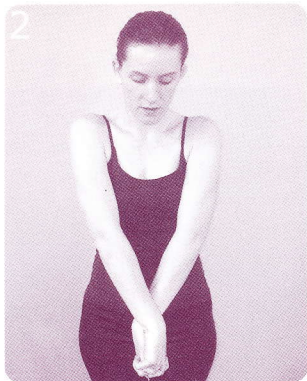
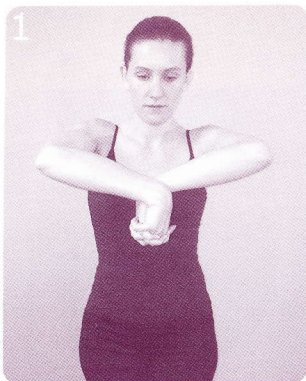


'Figures of eight'



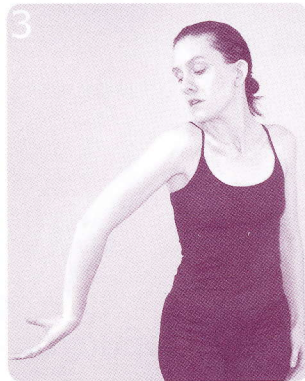
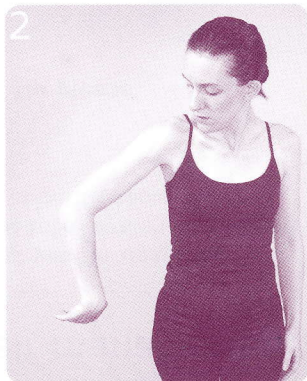
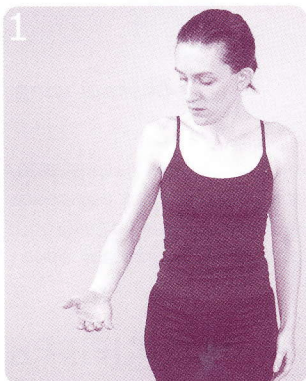
'Pouring water' and big swinging 'figures of eight' are gentle ways to mobilise the radial nerve and its representations in the brain. Make sure with the swinging technique that the shoulder internally and then externally rotates.

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'Pump water'

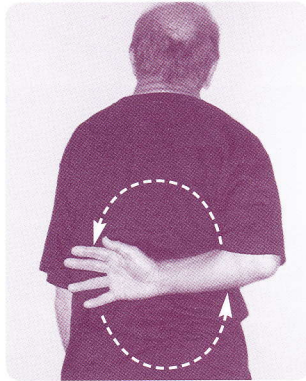
Pumping water allows the non-painful arm to help guide mobilisation of the painful/injured arm. The starting position encourages internal rotation.

**Look at your hand behind your elbow**

If the patient attempts to see their hand behind their elbow and to see their fingers and their thumb, this provides a vigorous sliding self mobilisation. Try it bilaterally - it's almost a dance move.

These are examples of stronger, yet functional self mobilisation movements. In the table stretch, the patient keeps the back of their hand flat on the table and then rotates their whole body away.

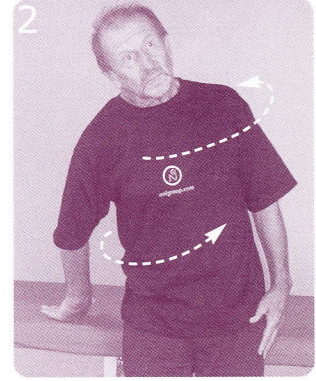
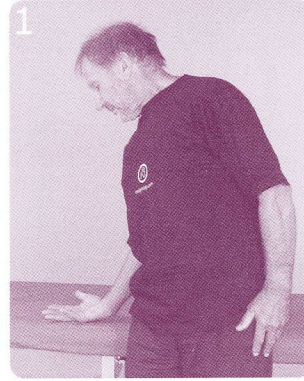
'Back massage'



'Tip please'



'Table stretch'



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Musculocutaneous nerve > anatomy and palpation

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Palpable areas

Difficult to palpate

Common entrapments/ syndromes

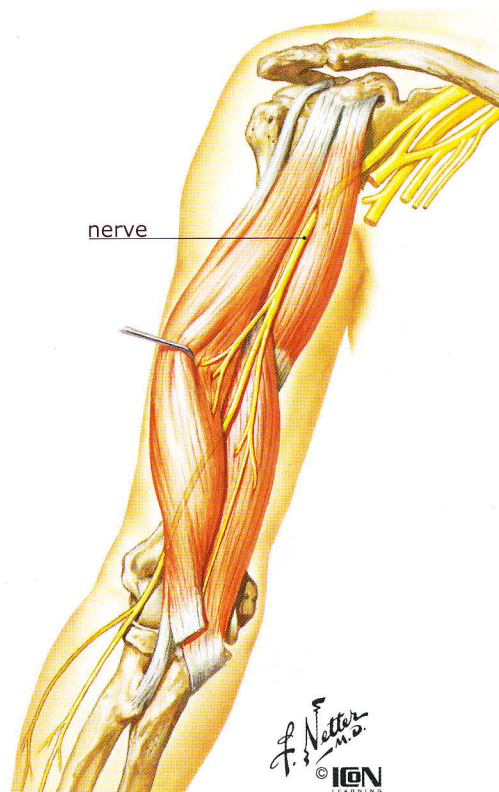
De Quervain's tenosynovitis

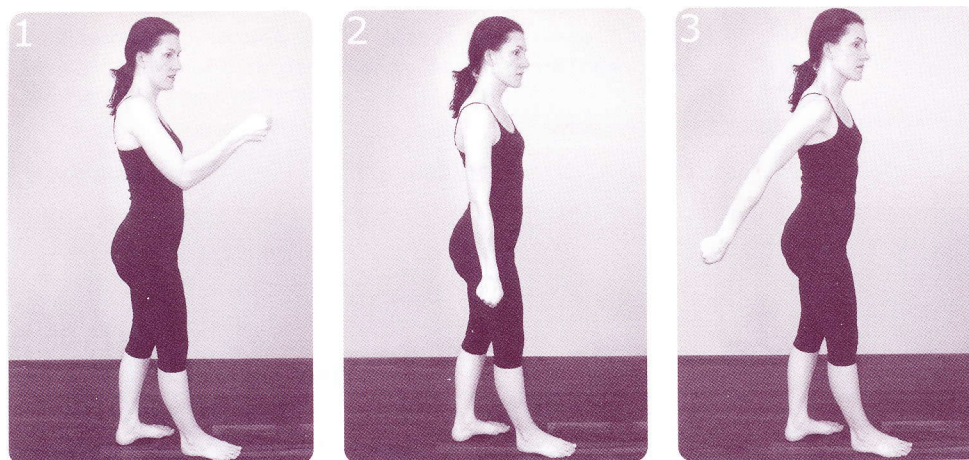
Tennis elbow 'above' the elbow

Post intravenous drip pain syndromes

The Sensitive Nervous System

Chapter 12





Make a fist, ulnar deviate the wrist, extend the elbow and extend the shoulder as though marching.

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Musculocutaneous nerve > therapist's assessment

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ULNT (musculocutaneous) This position can also be used for passive mobilisation.



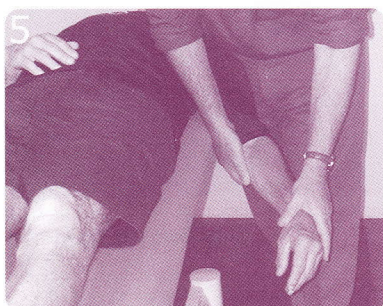
Starting position (same as the ULNT2 test for the radial nerve)



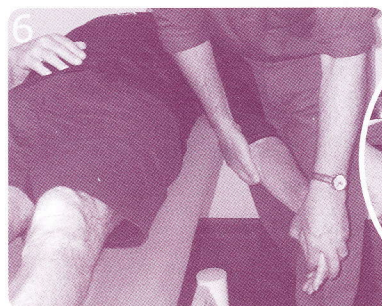
Shoulder girdle depression



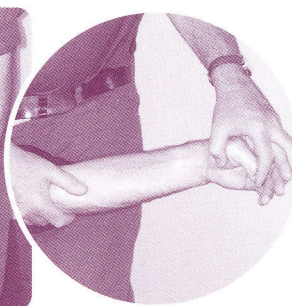
Elbow extension



Shoulder extension carefully

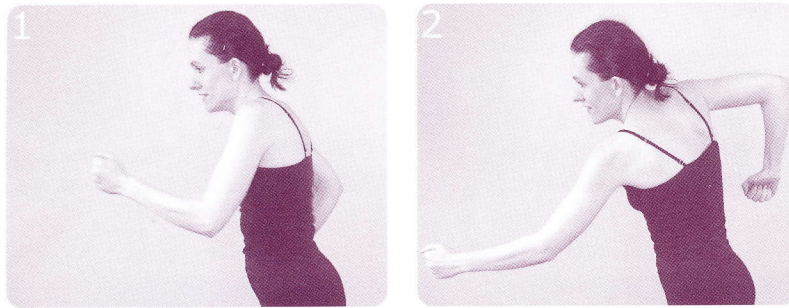


Wrist ulnar deviation and thumb flexion.
Either medial or lateral rotation could sensitise the nerve further.

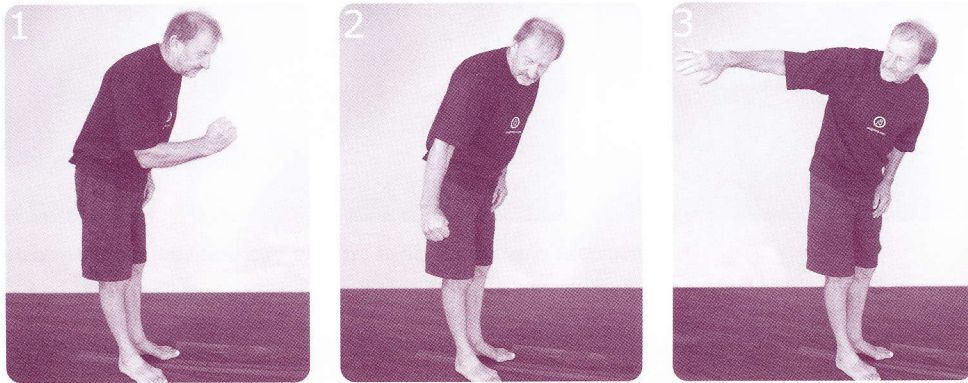


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Running on the spot



'Throw it away'



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Spine, cord and meninges > anatomy

p73

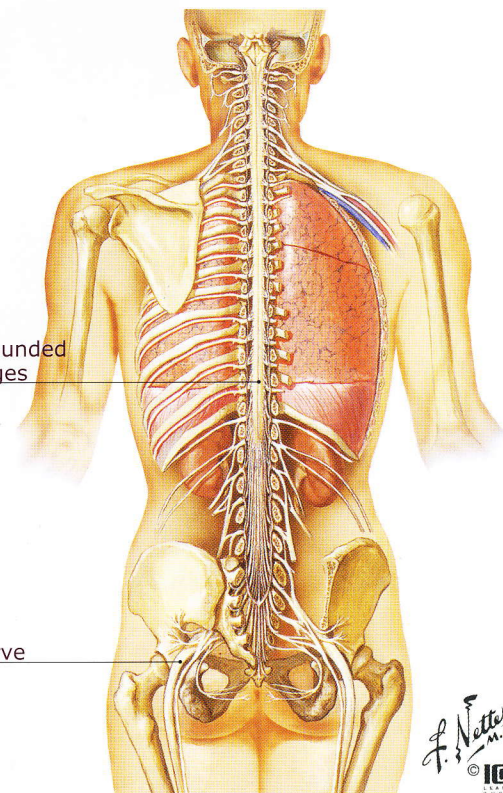
The spinal and cranial meninges (dura, pia and arachnoid mater) surround the spinal cord and form a continuous structure allowing force transmission from the peripheral to the central nervous system and vice versa. The spinal canal is between 7-11 centimetres longer in flexion than in extension, thus the meninges and spinal cord will be physically challenged in positions such as sitting, forward bending and especially the Slump tests demonstrated in this section.

The Sensitive Nervous System

Chapters 5, 11 and 15

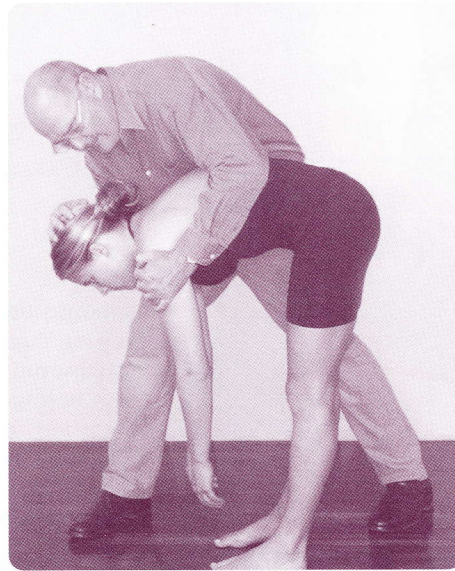
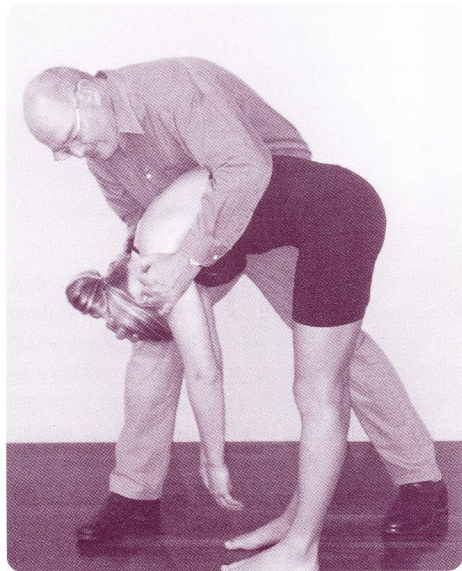
cord surrounded
by meninges

sciatic nerve



F. Netter
M.D.
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In spinal flexion the meninges and spinal cord will be physically challenged. If low back symptoms evoked by spinal flexion are made worse by the addition of neck flexion this infers that there is a physical health problem of the nervous system. Neck extension should relieve symptoms.



Spinal flexion

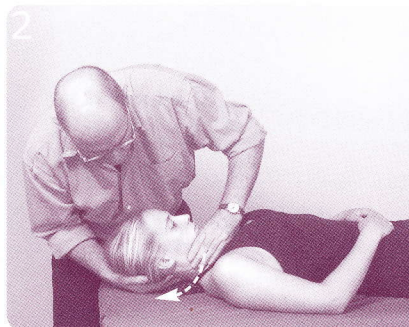
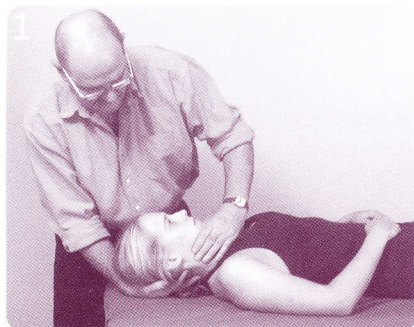
Neck flexion

Spine, cord and meninges > therapist's assessment

Passive Neck Flexion (PNF)

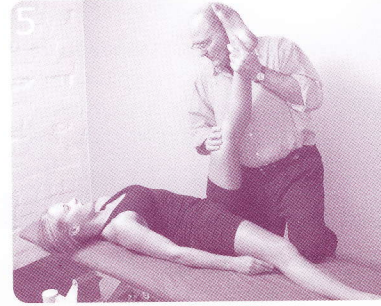
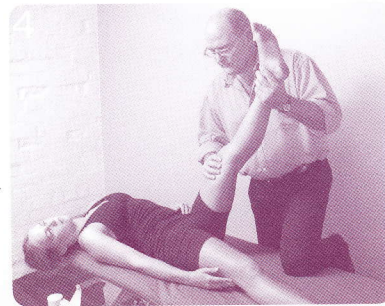
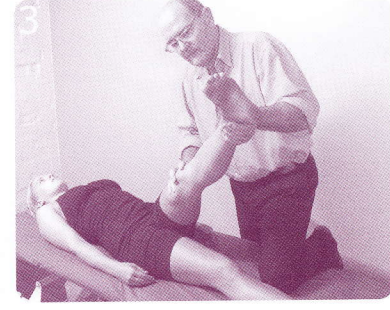
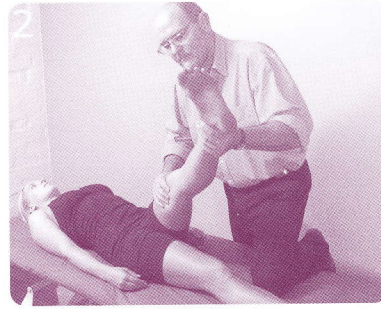
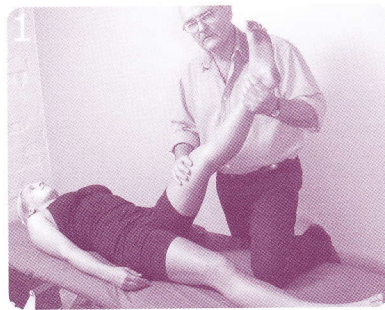
PNF can be performed in two ways. Upper cervical flexion (2), places load on the cervical and cranial meninges and if this is combined with lower cervical flexion (3), a considerable load is placed right through the entire neuromeningeal system.

PNF will frequently reproduce back pain, suggesting nervous system involvement is a frequent component of back disorders.



Straight Leg Raise (SLR) Sensitising movements

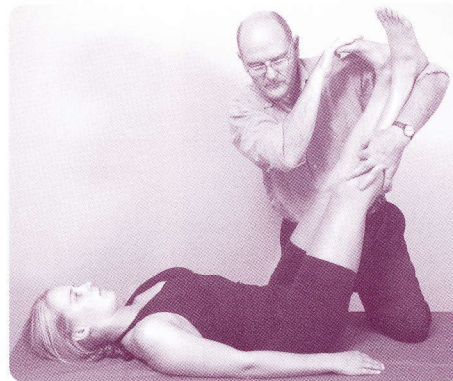
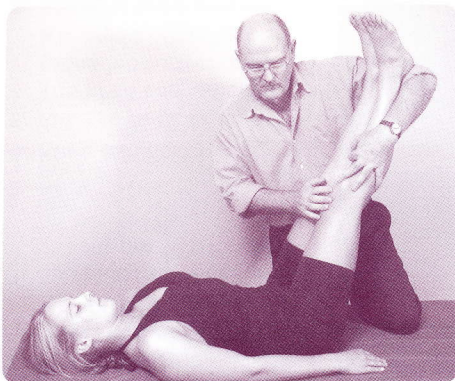
The nervous system sensitising movements which are frequently used for lower limb disorders can also be used for the neuromeningeal tissues.



Hip adduction (2), hip medial rotation (3), spinal lateral flexion (4) and upper cervical flexion (5) are shown. These movements may be required to identify minor disorders of the nervous system and any of these movements could be used to mobilise the nervous system.

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Bilateral SLR



Bilateral Straight Leg Raise (BSLR) techniques are useful and can be easily converted into self mobilisation techniques. BSLR provides a different biomechanical challenge to neuromeningeal tissues than a single SLR. In the example shown, ankle dorsiflexion is used as a technique.

The technique may be appropriate in patients with positive Slump Long Sit tests. Of course, neck and shoulder girdle movements could also be introduced as part of tensioner and slider techniques. Be creative.

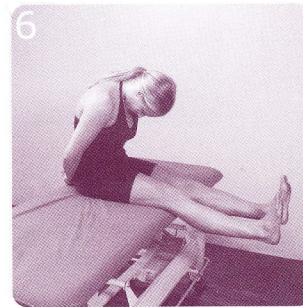
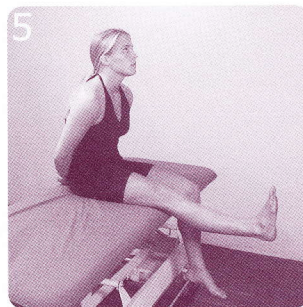
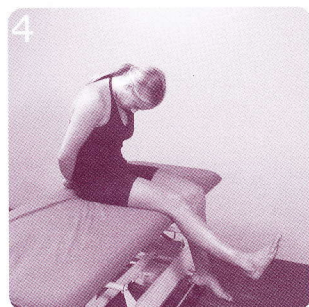
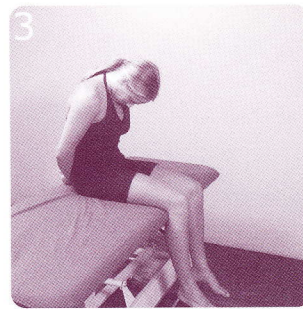
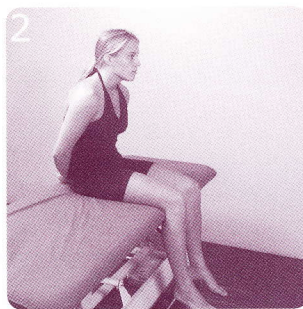
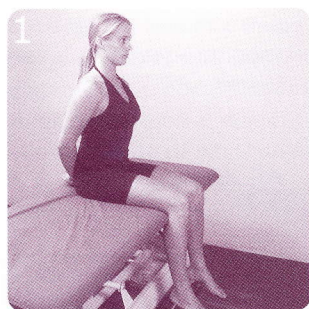
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Slump test active

It is best to perform tests actively first so the therapist and patient then know what to expect.

Check symptoms and symptom change at each stage.

1. Starting position, knees together and thighs well supported
2. Spinal slump, ensuring patient doesn't forward tilt her pelvis
3. Neck flexion
4. Knee extension
5. Release neck flexion.
The knee can usually be extended further and the ankle dorsiflexed.
6. Bilateral knee extension



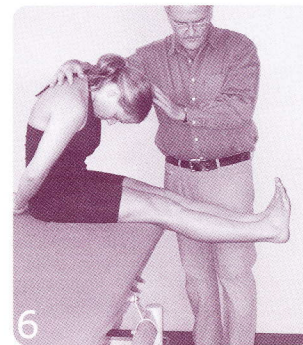
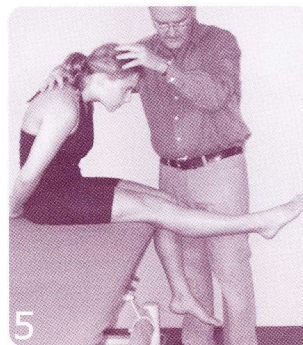
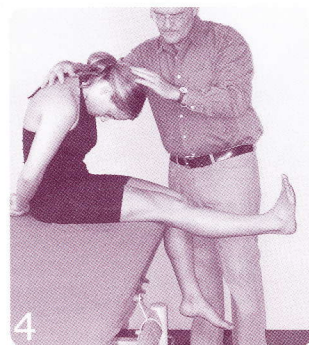
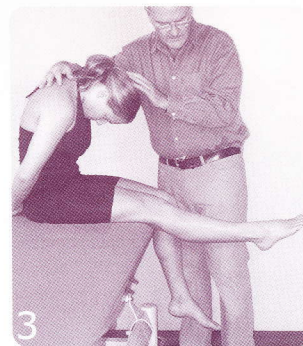
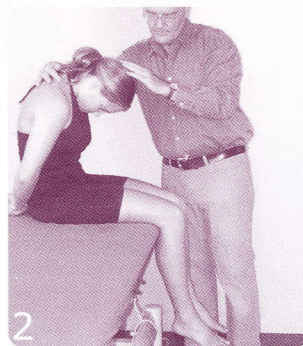
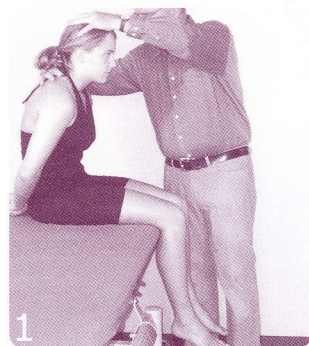
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Spine, cord and meninges > therapist's assessment

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Slump test passive

1. Spinal slump, making sure the patient doesn't forward tilt her pelvis
2. Neck flexion with gentle overpressure
3. Knee extension
4. Add dorsiflexion if required
5. Release neck flexion.
The neck is extended in stages checking the response to evoked leg and back symptoms
6. Bilateral knee extension if required

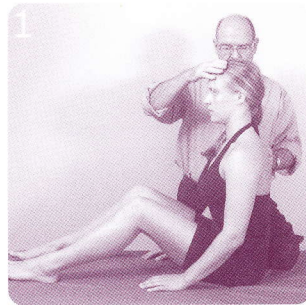


Slump Long Sit (SLS)

This test position provides a very stable assessment platform for neural problems in the spine and head.

Remember to check for symptoms at each stage of the test.

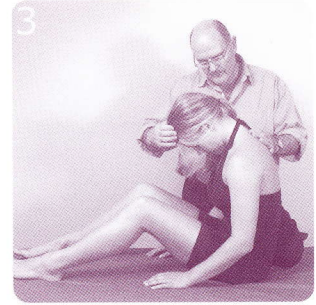
The test will need to be adapted depending on the patient. For those who are tight, pillows under the knees may be required and more hip flexion may be necessary for those who are more flexible.



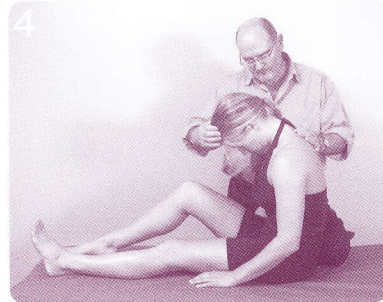
Starting position, the therapist uses his knee to stabilise the sacrum



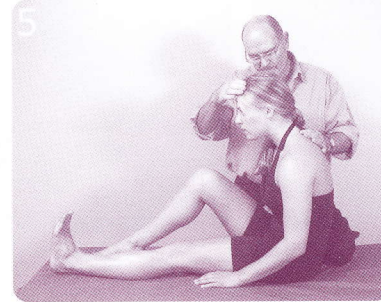
Thorax and lumbar spine slump



Neck flexion



Extend left knee



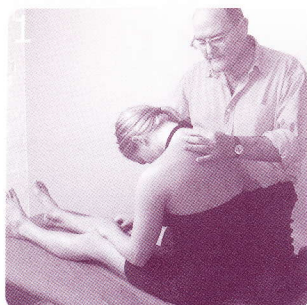
Release neck flexion to provide structural differentiation of any lower body evoked symptoms. Note how the ankle can be dorsiflexed further

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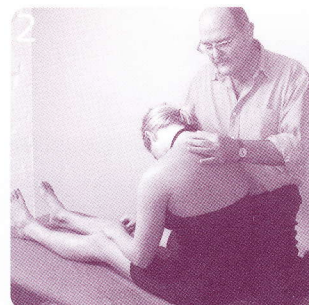
Spine, cord and meninges > passive techniques

Slump Long Sit / Structural differentiation

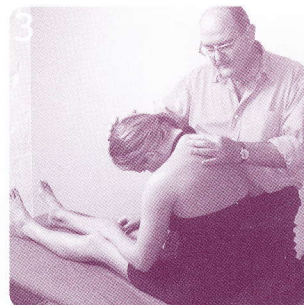
During the SLS test, a more refined structural differentiation can be performed.



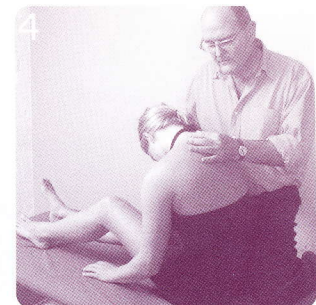
The patient is in a SLS position. This could be adapted as necessary, for example pillows under the knees or more spinal flexion.



The therapist stabilises the spine at the cervicothoracic junction.



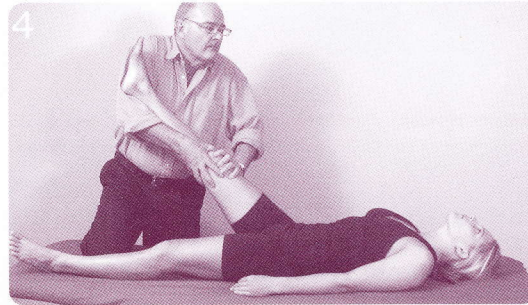
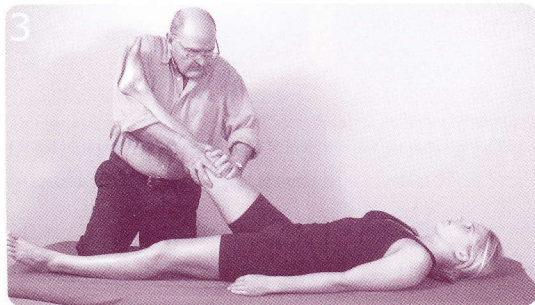
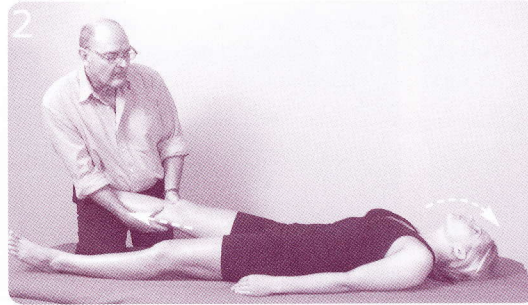
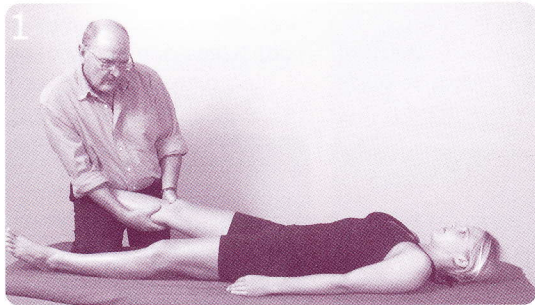
Lateral flexion of the entire cervical spine has been performed allowing a test of the physical health of upper thoracic neural structures. This will frequently produce relevant thoracic and lumbar symptoms on the convex side.



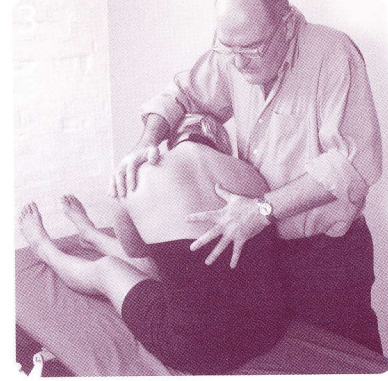
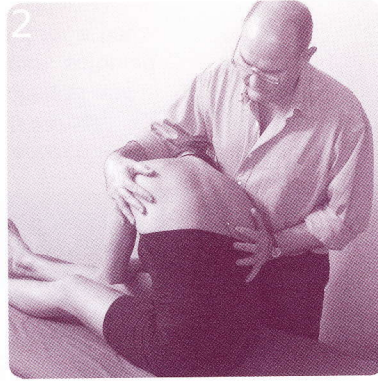
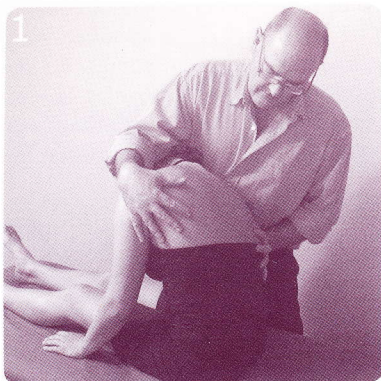
Structural differentiation can be performed by flexing the knee.

In: leg distraction Did: neck sli/ten

This is an example of a very gentle challenge to the spinal canal and its contained structures. First, gentle leg distraction is performed rhythmically. If the patient puts her head back at the same time this is a slider technique. The technique can be progressed by performing the same distraction in SLR.



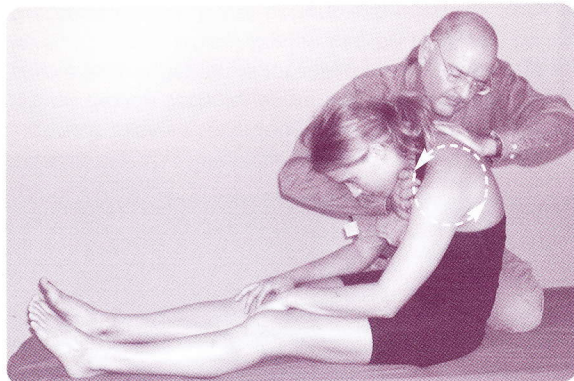
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In: SLS Did: Thx Lateral flexion techniques

On this and the following page are examples of some vigorous passive techniques for the thorax. Note the lateral flexion techniques above, including the third image where lateral flexion is localised to a specific and relevant level. Thoracic lateral flexion can be achieved by the therapist's body. If the patient extended her knee at the same time as the lateral flexion was applied, this would be a tensioner.

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In: SLS Did: A/P movements



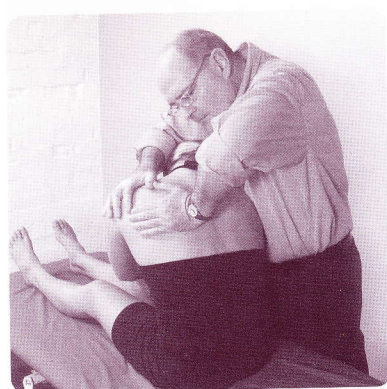
An anteroposterior movement can be applied in the Slump Long Sit. The therapist's left carpal tunnel is just under the level to be mobilised and his right hand is on the patient's sternum, softened by a towel or pillow. This may be useful for a flat upper thoracic spine relevant to a particular thoracic spine disorder.

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Spine, cord and meninges > passive techniques

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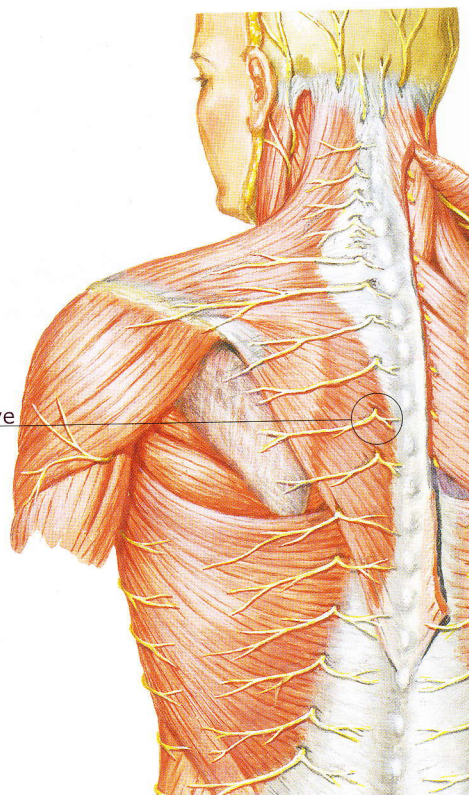
Notalgia paraesthetica techniques



This is an example of a refined technique for entrapment of the cutaneous branches of the thoracic posterior primary rami. The syndrome is called *notalgia paraesthetica*.

Tender spots, even nodules, may be palpated where these nerves exit the muscles and fascia to become cutaneous. These will be more tender in the Slump Long Sit position, less so if the neck is extended. Frequently the nerve will be more reactive if massaged laterally along the lateral branch, rather than medially. This may be an appropriate technique for some patients.

nerve

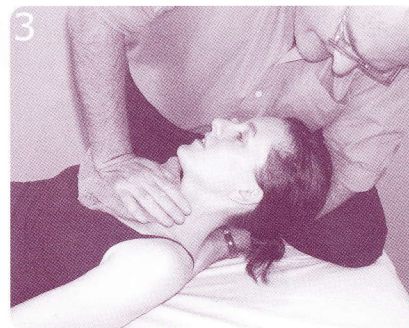
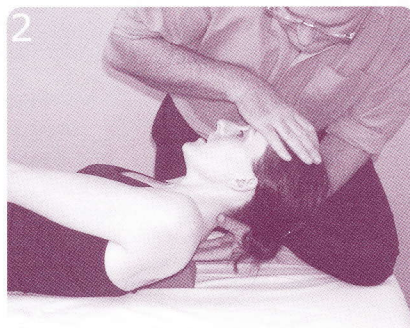
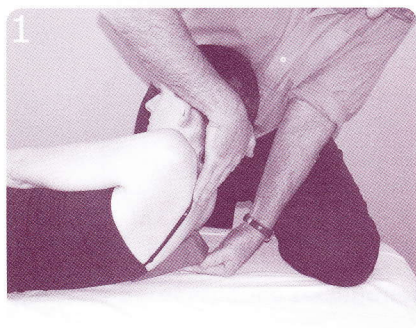


F. Netter M.D.
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IMAGING
SYSTEMS

Wedges can be a useful adjunct to passive and self mobilisation. In the example shown, the wedge is being used to facilitate a thoracic (predetermined level) mobilisation. The spinous processes lie in the groove of the wedge and the mobilisation is gently performed using the ribs. A towel or small pillow for padding makes it more comfortable. Because this allows a superior joint mobilisation it can also be used to mobilise associated neural tissue, for example, if the same technique was performed in Straight Leg Raise or Bilateral Straight Leg Raise.



Wedge mobilisation techniques / Thorax spine

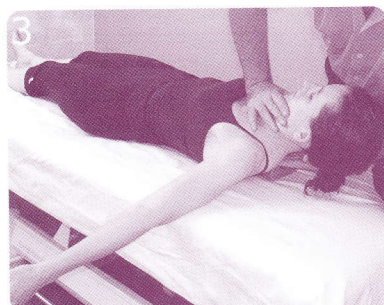
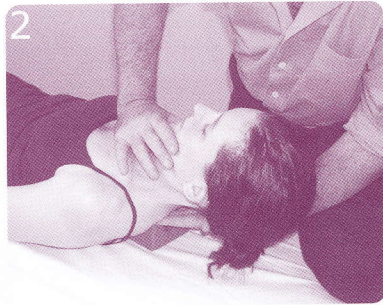


Spine, cord and meninges > passive techniques

Spine, cord and meninges > therapist's assessment

Wedge mobilisation techniques / Cervico thoracic area

Wedge techniques can be useful for the cervico-thoracic area. The force is through the clavicles not the jaw, and the therapist's left hand is only assessing the intervertebral movement while cradling the patient's head.



More tension can be placed on the nervous system during the mobilisation by adding an Upper Limb Neurodynamic Test (3 and 4) or Straight Leg Raise (5).

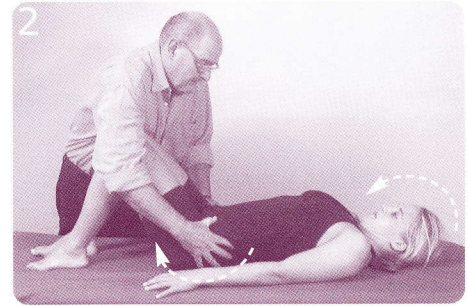
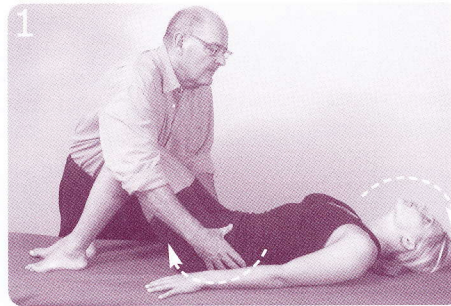


Spine, cord and meninges > self management
> gentler techniques

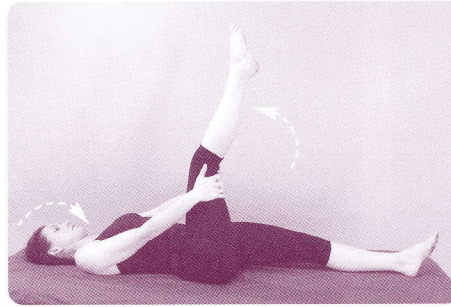
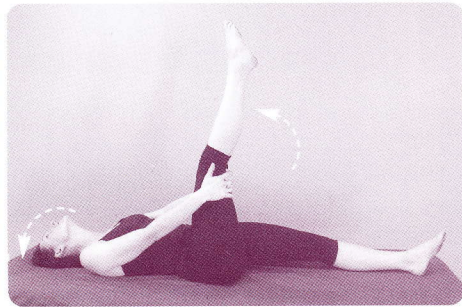
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Pelvic tilt/neck Sli/ten

Examples of gentle sliders (1) and tensioners (2) for the meninges and spinal cord.



SLR/neck Sli/ten



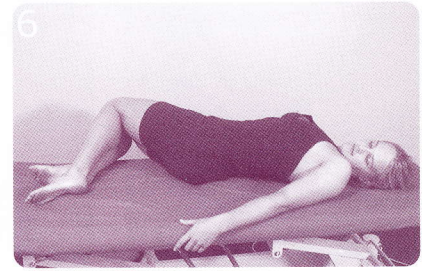
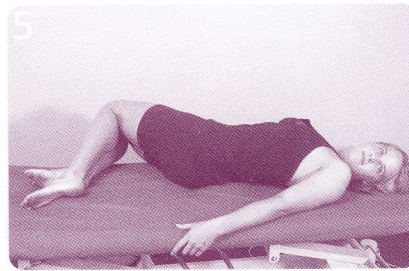
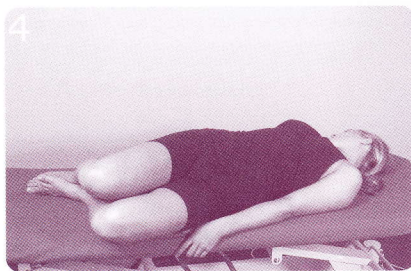
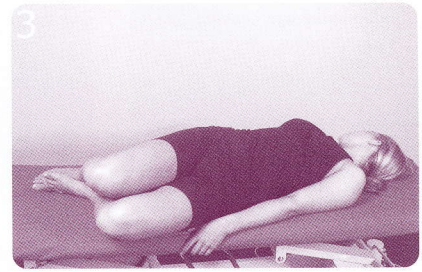
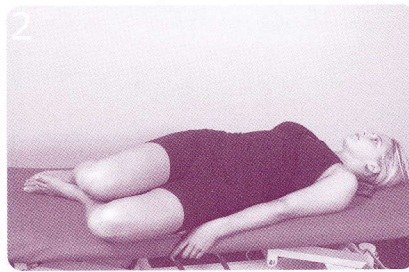
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Spine, cord and meninges > self management
> stronger techniques

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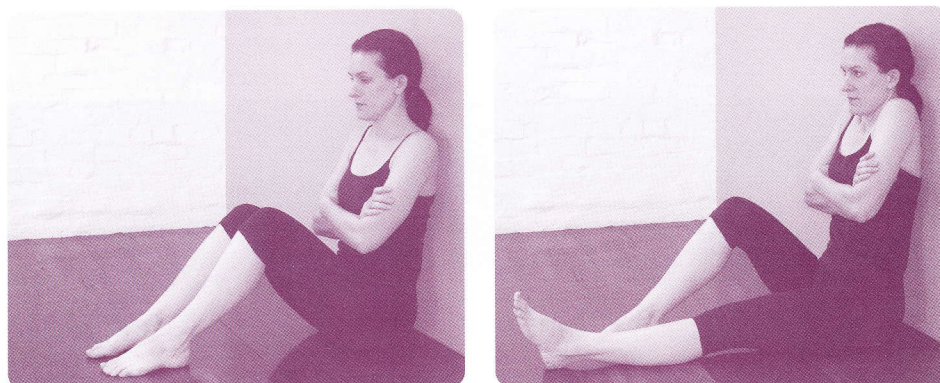
'Wring' technique

This technique is named after the action of wringing out a wet towel. With the knees flexed and rolling from side to side (2), a gentle wringing effect is placed on the spinal cord. If the patient turns their neck away at the same time (3), a more aggressive wringing is provided, and if the chin is tucked in (4), even more load can be applied. By using the arms and depressing the shoulder girdle (5), even more load can be placed on the nervous system.



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SLS / Shoulder shrug

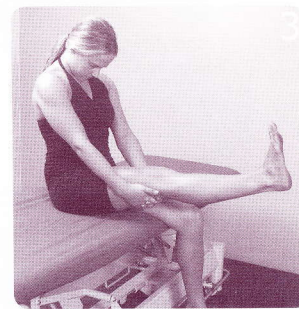
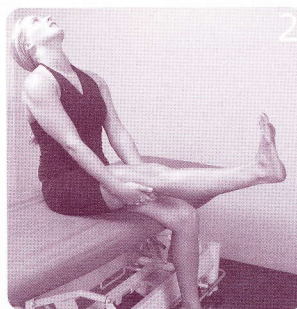
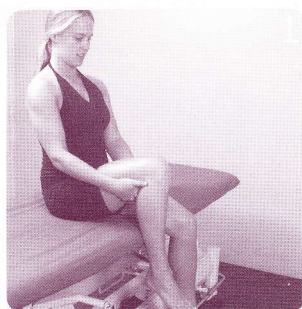


The SLS position offers a safe and supported starting position for self mobilisation. In the images, a slider is being performed. As the patient extends her knee, she shrugs her shoulders. This may be a useful slider when the neck is sore. In this position there are many combinations of sliders and tensioners. For example, if the knee is extended at the same time as the neck is extended, this creates a slider movement.

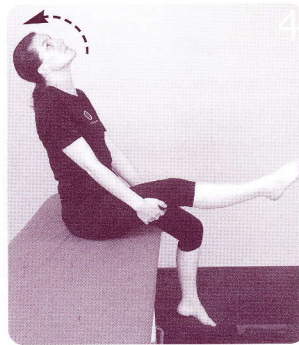
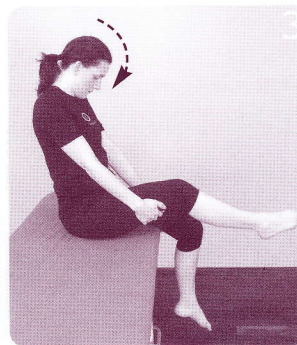
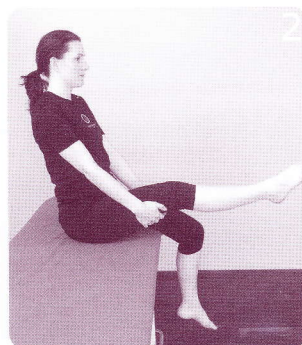
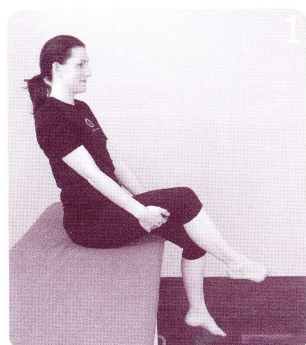
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'Kick your head off'

These are stronger sliders and tensioners for the lower limb and meninges. They can be adapted to focus more on the peroneal or tibial nerves. This not only mobilises neural tissues but provides movement in a novel and safe way.

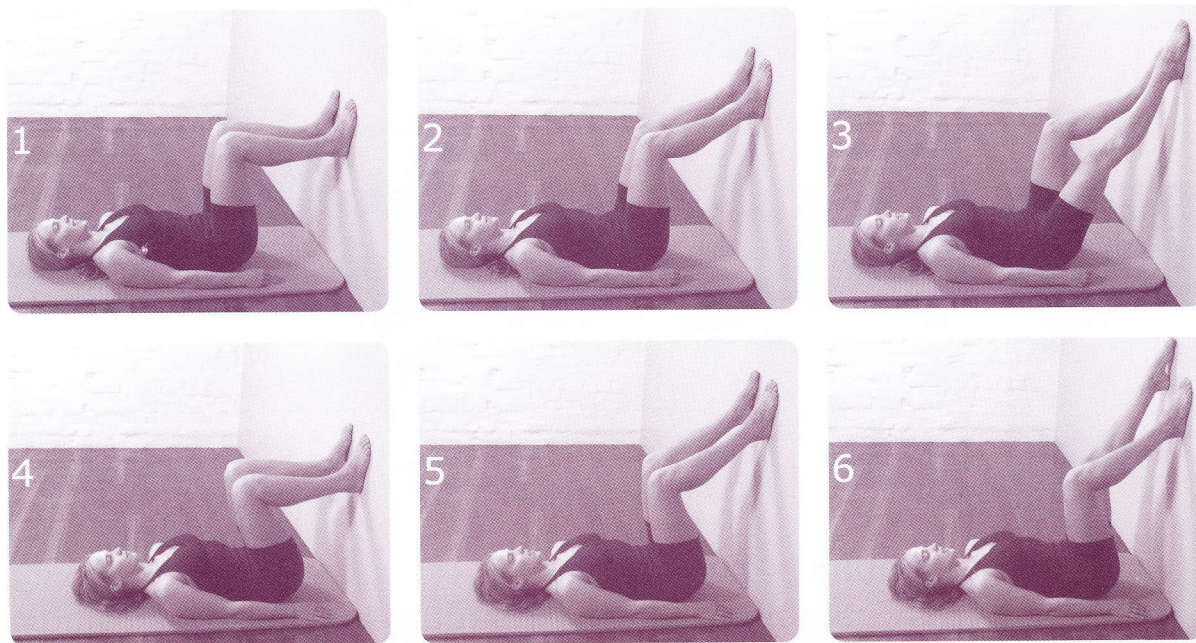


'Kick your head off' Focus on peroneal nerve



'Wall walking'

Images 4, 5 and 6: Notice how the patient moves closer to the wall to achieve more Straight Leg Raise.



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'Total slump'

Bob Johnson technique

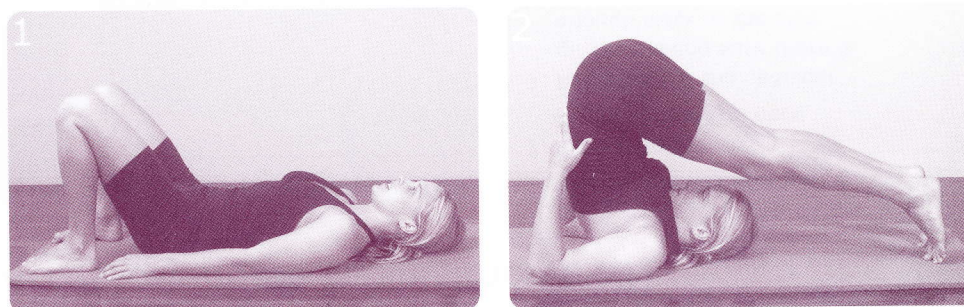
Two vigorous mobilisations are shown here.

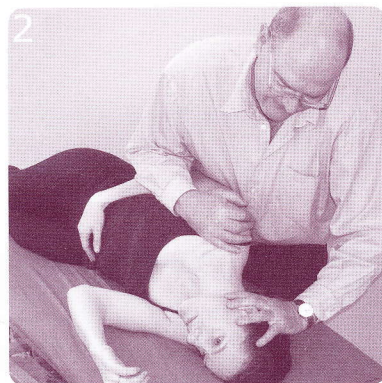
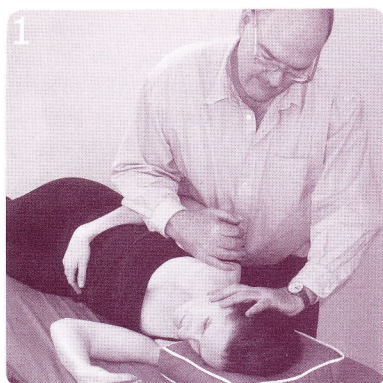
Notice how the standing total slump uses order of movement principles to load cervical and cranial meninges first.



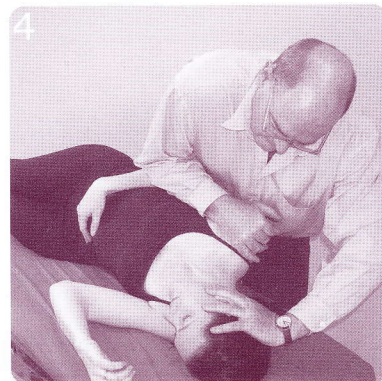
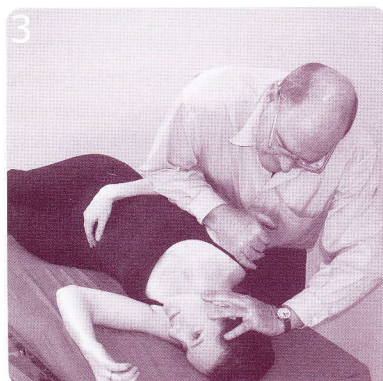
'Roll over'

In the roll over position for the appropriate patient and problem, further mobilisation can be performed by leg movements.





1. The patient lies in sidelying
2. Lateral flexion and protraction of the neck
3. Retraction of the shoulder girdle, making sure there is enough slack in the skin
4. Upper cervical flexion will add more load



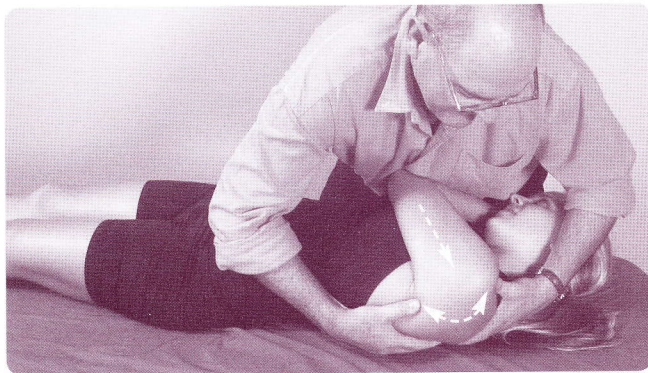
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Other nerves > Axillary nerve

A neurodynamic test can be placed on any nerve, simply by observing where the nerve is in relation to joint axes of movement. A test for the axillary nerve will be a combination of neck lateral flexion, shoulder girdle depression and internal rotation. Any of these movements could be used for mobilisation. The axillary nerve may be injured post shoulder dislocation.

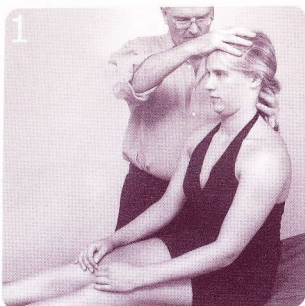


The suprascapular nerve is challenged in a combination of neck lateral flexion and shoulder girdle depression. A force down the humeral shaft takes the nerve further from its roots and finally the scapula can be rotated as a mobilisation technique.

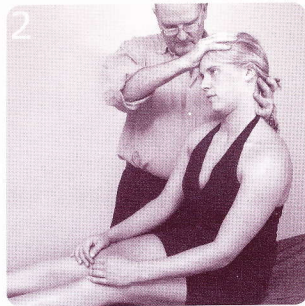


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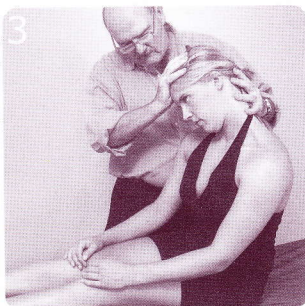
Other nerves > Trigeminal nerve



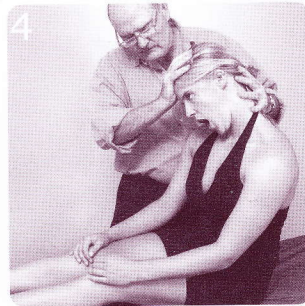
Upper cervical flexion



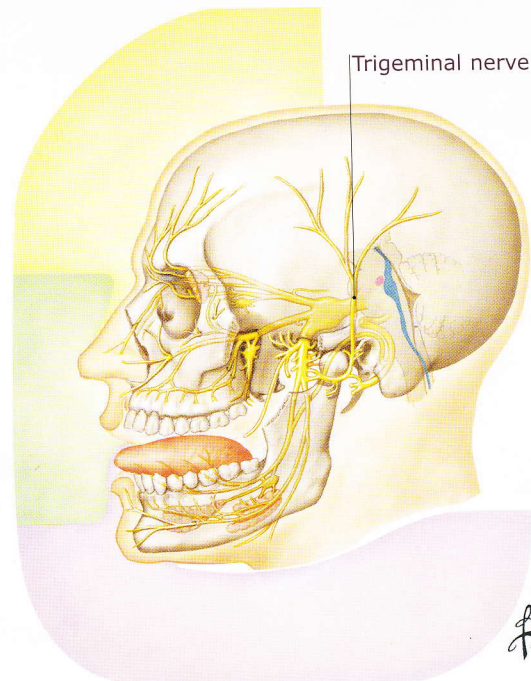
Upper cervical lateral flexion



Total cervical flexion

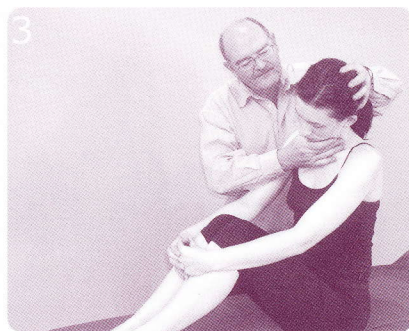
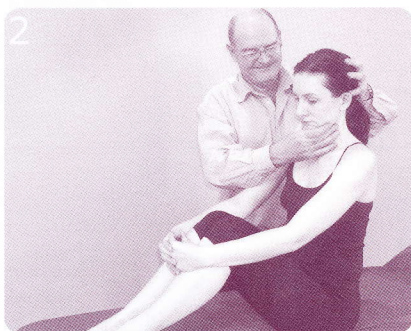
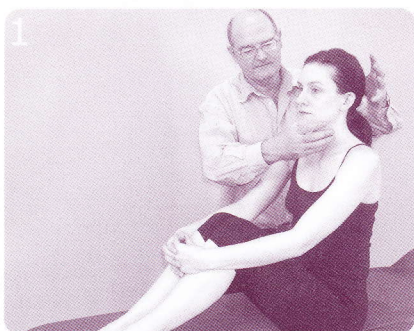


Open mouth and move jaw to the right



F. Netter M.D.
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IMAGING
SYSTEMS

The greater and lesser occipital nerves can be challenged in upper cervical flexion and lateral flexion of the neck away from the side to be tested.



Support material

NOI's list of self published literature and brain training products is continually updated and expanded. Visit noigroup.com for detailed descriptions and secure online ordering.

The Sensitive Nervous System

Updates and integrates the growing science of neurodynamics into current practise. Physical examination of the nervous system is carefully illustrated and explained. ISBN 0-646-40251-X, Butler DS, Noigroup Publications (2000), Hardback, 430 pp, 300+ illustrations.

Explain Pain

Based on emerging evidence, this book shows that explaining neuroscience to patients can change their behaviour and promises to be of value to sufferers of pain as well as clinicians. ISBN 0-9750910-0-X, Butler DS and Moseley GL, Noigroup Publications (2003), Adelaide, 130 pp, 90 illus.

Explain Pain Poster Collection

Used in a pain peer group setting, or as an educational tool hanging on the clinic or waiting room wall for everyday use, these posters will help pain sufferers to make informed choices and guide them to recovery. Four posters, each A2 size (42cm x 60cm), plasticcoated finish.

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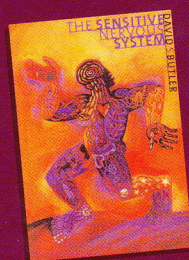
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